# AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 8, No. 12. WEEKLY. | NEW YORK, MARCH 21, 1885. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.



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## E. D. Leavitt's Pumping Engine "Ontario."

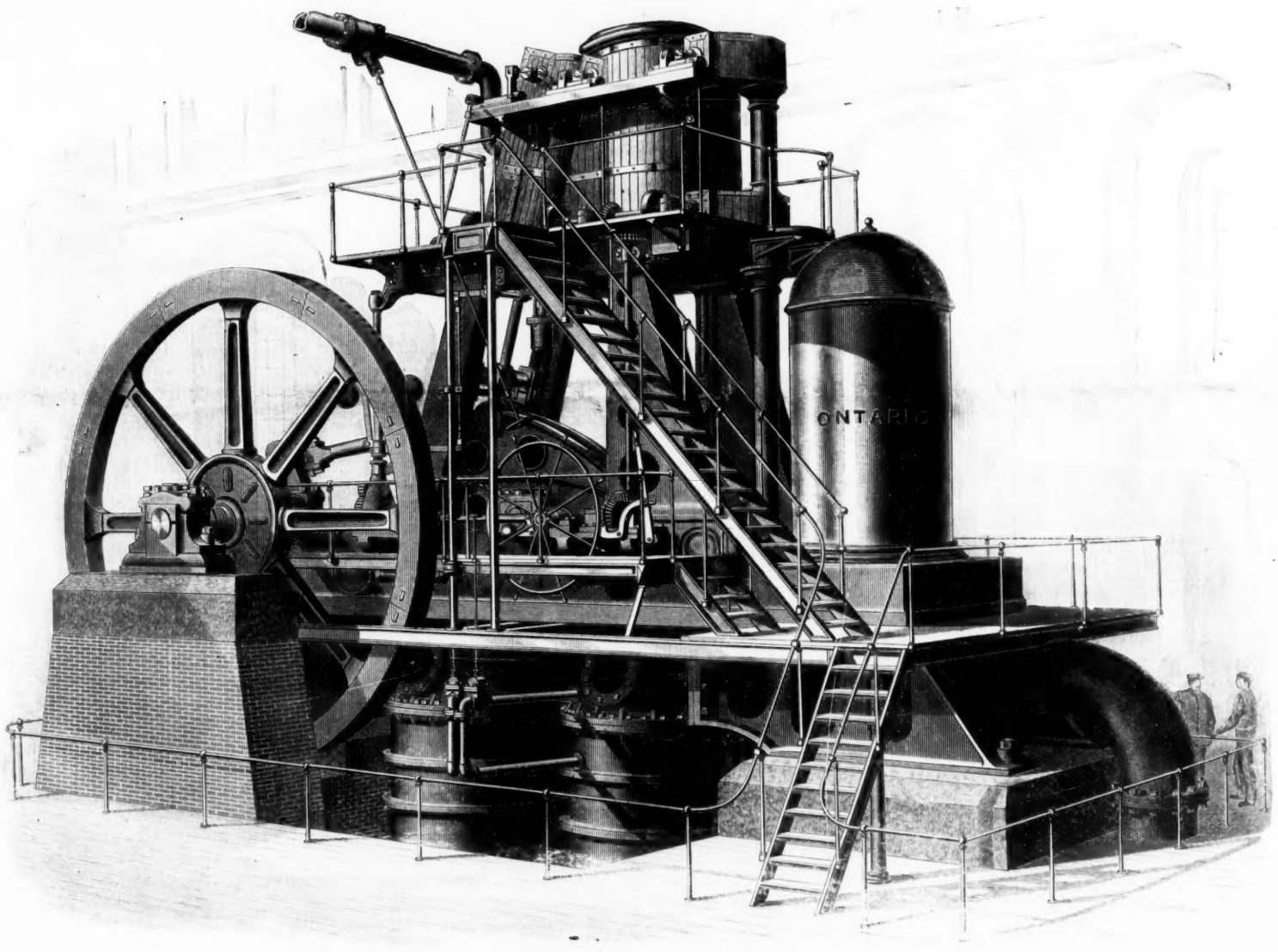
The large engine "Ontario," shown in our engraving, was designed by E. D. Leavitt, Jr., and built under his supervision at the Dickson Manufacturing Company's Works, Scranton, Pa. The Calumet and Hecla Mining Company have an extensive plant of pumping machinery in use connected with their ore-stamping operations, and this inverted compound engine is the larger of two engines employed upon the work. It has a vertical low-pressure cylinder 36 inches diameter, and an inclined high-pressure cylinder 17½ inches diameter, the stroke being 5 feet. These are inverted over a beam or rocker, and the pistons are connected to opposite ends of the same.

The beam attachment of the main connecting rod is made to a pin located above and midway between the pins for piston connection. The main center of the beam and the crank shaft have their pedestals in the same horizontal plane. The throw of the crank is 5 feet. There are two differential plunger pumps having upper plungers 20 inches in diameter, with a stroke of 5 feet. These pumps are vertical, and placed beneath the engine bed-plate, to which they are attached by strong brackets. The pump under the low-pressure cylinder is worked direct from its cross-head by an extension of the piston-rod. The other pump is worked by a trunk connection from the opposite end of the beam. The radius of the beam is but 50 inches, but the connections to it are made by very long links.

The lower plungers work through sleeves in diaphragms located in the center of the pumps. In these diaphragms the openings for the delivery valves are made. The pump valves are annular, of brass faced with rubber, and closed by brass spiral springs. Their external diameter is 5¼ inches, and the lift is ½ inch. There are 72 suction and 72 delivery valves for each pump. The "Ontario" was designed to run at a maximum speed of 33 revolutions per minute, and the service required is to run regularly 144 hours per week without stopping, which is performed with great regularity.

The differential pump used is very efficient. One of the kind was run at the Hecla mine for several years successfully at a speed of 500 feet per minute.

In the AMERICAN MACHINIST of June 25 and July 2, 1881, we illustrated a very large compound pumping engine, the "Superior," also designed by Mr. Leavitt, and which attracted a great deal of attention in the engineering world. This engine is in use at the Calumet and Hecla Company's mines, and is a very successful pumping engine.




THE PUMPING ENGINE "ONTARIO."

## Experience of a Tramp Machinist in Striker's Shop.

BY JAMES F. HOBART.

John Striker's business was "booming." He had orders for three new threshing engines, one water wheel, ten brick machines, and a lot of shafting. Striker had twenty men, and wanted more. Times were picking up, men getting scarce, and good ones hard to get. One day a chap walked in and wanted a job. "What can you do?" said Striker. "Most anything they do in any shop," said the tramp machinist. "Where have you been to work?" "Oh, down to Racket's, and Parson's, and Quimbly's," said Tramp. "Can you file up connecting rods?" said Striker. "You bet I can," was the reply, and Striker set Tramp to work at the old vise by the north window.

Tramp unrolled his overalls, laid his hammer on the bench, and fished out two pair of calipers, a scale, square, dividers, and "scriber" out of the sleeves of his blue jacket. He cleaned a miniature junk shop out of the drawer, packed in his plunder, and looked at his vise. Poor Tramp! He felt tired when he looked at that vise. The corners were knocked off the jaws, it was sprung, the spring had taken a set, and the vise jaw required to be "yanked" every time he unscrewed it. The boys had been cutting 2″ steam pipe in that vise, and it could be twisted around that bench like a button on a school-house door.

Tramp took in the whole business, and then sat down on a nail keg. It made him feel tired. Striker came along and asked, "What is the matter, hain't you got straightened out yet?" Tramp got up and gave the vise a shake. "Fix it," said Striker. "All right," said Tramp, and he did fix it. He yanked that vise off in a hurry, tore down the shackly bench and built it up new. Striker has built all his benches over since then. He put a 2″ casting, 10″ wide, in place of the usual front plank. It works nicely. It is always true, solid, and handy. Tramp took that vise by the leg and run it out to the blacksmith shop. "Don't it hold?" said a cub. "Yes," said Tramp, "just about as much as I can hold between my knees."

How the grease sizzled and smoked as Tramp took a heat on the jaw of that old vise. Down by the pin it seemed about all grease. Tramp welded a piece of steel to each jaw; in fact, he "new laid" the vise, and built up the jaws square and true. He heated the spring, bent it back into shape, and just as it got cooled down to a dull, shiny red, he dumped it into the oil tank.

When Tramp put that vise up again he

bolted it to the bench. No screws for him. He put the vise up to stay, not to swing back and forth like lazy tongs, as it did before; and when he put a connecting rod between the jaws, he was sure it would stay put.

Striker brought along a rod. It was about $1\frac{1}{2}''$x$2\frac{1}{8}''$, flat sides, round edges, and 29″ long. There was a "flaw" in each side about 10″ long. Tramp "goes for it" with a cape chisel, and cuts a clean, smooth channel. A piece of the same kind of iron is nicely fitted in the channel, and "peened" until it fills the hole chuck full. Tramp files it down smooth. The flaw on the back side of rod will be out of sight. Striker says "Lead it," and Tramp drives in a strip of lead instead of iron.

"Go to the office and get some files," said Striker. Tramp went up and got a 12″ "bastard," a "second cut" with 44 teeth to the inch (the "bastard" has 32, and a "rough" 22); two "smooth cut" files having 68 to the inch, and a "dead smooth" with 120 teeth to the running inch. He will rub a little oil on the "bastard" and "second cut" files. It prevents the teeth from "cracking" while they are new—that is, it keeps the delicate, sharp edge from splitting off when first used. He uses those files very carefully for the first hour or two. He lifts them up clear of the work during the return stroke. He knows that if he drags a new file backward he is liable to wear it out more than the cutting does. When Tramp gets the planer tool marks about out, he takes his fine file, rubs the teeth full of *chalk*, and goes for that rod with vim. He squints along his file, finds a rounding spot thereon, and works with that spot. He knows that a file will spring. He knows that files don't get made straight; so he takes advantage of the crooked places. The hollow places he will use when draw-filing the round edges of the rod. Tramp knows that chalk will prevent chips from sticking in his file. He knows that chips will play mischief with his work; they will make a big, nasty scratch, and he will have to work that place all over again.

Tramp keeps his hands off his work. He knows that the sweat and grease from them don't help his file any. He knows that he must keep his file clean. He has not got a file cleaner, made of a piece of card clothing glued on a stick. No; he uses a little pine stick to clean his files with. He rests one end of the file on the bench, strikes with the corner of the stick at an angle of 20°, and follows the cut of the teeth. Tramp cleans his file a dozen times while he would be finding a cleaner once.

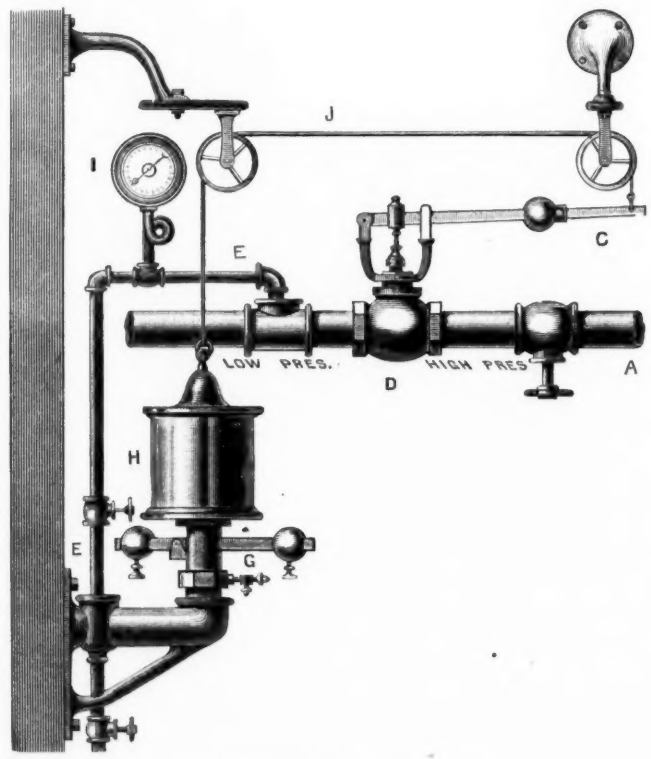
This man knows that he cannot work a flat surface with a hollowing file. He knows that the corners and edges of his work will get dubbed off if he tries it; so he makes sure what part of a file he uses. When he draw-files that rod, he don't hang on to each end of that file as if he was using a burnishing iron. No, sir! He puts his thumbs on the file just over the work, clasps the file firmly with palm of hand on top and fingers underneath, then puts on pressure with his thumbs, and keeps the file from bending down at the ends, with his fingers.

Not a trace of that flaw is visible when Tramp gets done. It is gone root and branch. He fits in the brasses, the strap, key, and pin. Some things are not interchangeable in John Striker's shop. He can't afford to have special rigs for everything, but his connecting rods are all planed to gauge, the straps are milled to fit the brasses all alike, but Striker finds that sometimes they won't stay so over night, and it is cheaper for him to file off $\frac{1}{200}''$ than to rig up practical perfection. In this case our Tramp finds the strap "just a little" too small. What now? Does he fill it out? No. The brasses are as large as the rod. Tramp gets an arbor just large enough to fit inside the strap, which is placed thereon and given twenty smart taps with the hammer. Not quite enough. A few more blows and one edge of the brass is just right. Two or three taps bring the other edge to time. Tramp works off the hammer marks, and finishes up that rod and strap with emery paper. Striker don't care for any stone finish on his agricultural work. It don't seem to be appreciated among his customers. He don't paint any flowers on his engines either; or one-legged cranes, or tired storks on his threshing machines, or put any decalcomanie pictures on the buckets of his water wheels. The ideas that line in John Striker's shop don't put him up to any such nonsense.

John has all the gates chipped off, and the cope marks too. He fills the blow holes with lead putty, mixed to harden. He reduces the putty with spirits and dyes, and coats the whole casting with it. It makes a surface like Japan. Two coats of American vermilion make a good looking color for general work. No ecru machines or parffine-filled castings from John Striker's shop, or any dead black machines either. A threshing machine painted a nice red, will sell to Uncle Hayseed twice as easily as one painted with tar paint, or abominable "steel blue."

When Striker gets a man like Tramp, he generally figures to keep him. He is a first-rate man at the vise or on the floor, but he don't amount to "shucks" on lathe or planer. One day Striker was in Racket's shop and asked him about Tramp.

"What kind of a chap was he?" said Striker. "Well," said Racket, "he's a good fellow; a first-rate chap, but he isn't worth a tinker's dam in a machine shop."




Automatic Pressure Regulator.

"Did you ever work him at the vise?" said Striker. "No; he run that 24″ lathe about five weeks, and made so many blunders and poor fits that I had to let him go."

That is the trouble with Racket. He can't find out a man's value. He has a man now on the boring machine who ought to be running a tumbling barrel in the foundry, and that raw boned, gawky Ned, who engineers the nut tapping machine will find his level when he gets to the gear cutter. Striker learned a lesson or two in this line. One day he must have a 6″ taper tap 11 pitch $\frac{7}{8}''$x$\frac{3}{4}''$. All hands were busy and he set Tramp at the job.

Tramp started off in good shape. He cut off a piece of 1″ octagon steel and annealed it. He centered it, drilled the centers, squared up the ends, and turned up the shank, then set over the tail block, and turned down the body of the tap. "What gears do I want?" thought Tramp. "Let's see: to cut 11 thread with 4 screw, I want gears in proportion of 4 to 11; well 20 and 55, or 24 and 66, or 40 and 110," and Tramp found a 40 gear, and another with 110 teeth. "40 on stud, 110 on screw," thought Tramp. "I want to cut finer than the lead screw, so I'll have a smaller gear on the stud." Tramp didn't care anything about the index plate to find his gears with. He had studied out the theory of the thing and he could figure out a couple of gears in half the time he could rub the dust off the figures on the index.

When he got all rigged he hunted up a tool and ground it. "Want a clean, sharp thread on that tap," said Striker. Tramp ground the tool to gauge, and then *ground off the point*. He knew he could not take two cuts with a sharp tool, without losing the point, and he would have to be grinding half the time, but this round-nosed tool stood right up to the work, and cut a big, nice, clear chip. When almost down, Tramp ground the tool to a point, and finished the job. It *was* a clean cut tap and a good job. Striker began to think that Racket was "off his base" when he said Tramp was no good at the lathe.

Mr. Tramp finished turning, polished with emery and oil on the end of a stick, and fluted the tap in the milling machine; then went down to the forge and tempered it. He heated it slightly, rubbed the thread full of hard soap and finished heating. What a nice, even, dull, red heat he had when he slid the tap into the water tub. It came out clean and white. The soap had kept it from scaling, and potash don't soften steel a bit.

Tramp let down the temper. He held the tap over the charcoal fire; held it up high, just in the top of the flames. It took a long time to start the temper, but when it did start, it was all of a color—no grey or blue spots, but a uniform color. Tramp cooled it off when he thought it was "about right."

The tap came out in good shape. It was *straight*, well-shaped, a good cutting angle, and plenty of room for chips. Tramp took the tap to Striker, who set out to tap a hole in a $2\frac{1}{2}''$ casting. Striker twisted that tap around a dozen times. It would not "take hold." What is the matter? He looked at the tap; it seemed all right, and he tried it again. No use. Striker tips up that tap and squints along its length, then turns it around and squints again—"jewhittiker! but Racket *was* right though. That confounded bungle-headed Tramp has fluted this tap *left handed*."

## Kellam's Automatic Pressure Reducer and Regulator.

These regulators are used in any instance where it is desirable to use steam for different purposes at different pressures from the same boiler, or where for any reason it is desirable to use steam of less than boiler pressure. For steam heating they provide for admitting the pressure required in the pipes or radiators to maintain the desired temperature, regardless of the rise or fall of pressure in the boiler. They can be instantly set to maintain any desired pressure (and temperature); for instance, at night they can be adjusted so as to provide for circulation just sufficient to prevent freezing. They will prevent the full pressure from boilers in which high-pressure steam is carried being accidentally admitted to the heating pipes or radiators, damaging or bursting them.

In many instances they avoid the necessity of using a special boiler in which low-pressure steam is generated for heating. This is a matter of considerable importance in buildings in which an elevator is used, and in which the rooms are heated by steam.

For manufacturers using steam heat in the treatment of their products, they provide a means for certainly regulating the heat to the requirements—very frequently a matter of great importance.

The engraving represents the regulator attached for controlling steam pressure. To the main steam pipe, *A*, leading from the steam-supplying boiler, is attached a balanced valve, *D*, which is opened and closed by a weighted lever, *C*, controlled by a wire rope, *J*, which, passing over pulleys, is connected with the regulator, *H*. The pressure desired is regulated by the small ball on the lever, *G*. At starting the valve, *D*, is wide open, and will so remain until the receptacle becomes heated, and by a back pressure indicates on the gauge, *I*, the heat or pressure required. This is obtained by the connecting pipe, *E*, being placed at the low-pressure end of the valve admitting steam to the regulator. As soon as the desired pressure is indicated, the cylinder of the regulator rises, and so shuts off the valve that a uniform pressure or heat is obtained; the regulator varying up or down as the pressure increases or diminishes.

Hine & Robertson, 12 Cortlandt Street, New York, are sole sales agents for these regulators.

## The "Pop" Safety Valve Controversy—A Supreme Court Decision of General Interest.

The recent decision of the United States Supreme Court, to which we have already briefly referred, by which the validity of two patents granted to George W. Richardson, and owned by the Consolidated Safety Valve Company, is affirmed, is of interest to inventors and those owning patents or manufacturing patented devices. It defines in a particularly distinct and emphatic manner the right of an inventor to what he invents. The salient points in the "Pop" safety valve controversy, extending through the lifetime of one of the patents, may be briefly stated:

In 1866 George W. Richardson, then in the employ of the Troy and Boston Railroad Company, patented a spring-loaded safety valve, in which the steam, after leaving the ground joint, passed into an annular chamber surrounding and attached to or forming part of the head of the valve, where it exerted additional pressure to raise the valve from its seat against the increased and increasing tension of the spring. The passage way for the steam from this annular chamber to the atmosphere was restricted, and upon this depended the results obtained with the valve. These results were such as had never been obtained before in the use of a safety valve. Of this there has never been any question. Applied to a boiler, Richardson's valve would open sharply at the exact pressure at which it was set, blow rapidly, and after reducing the pressure in the boiler by about two pounds, close as abruptly as it opened, accomplishing this under ordinary conditions in a few seconds of time.

Comparison was hardly possible between this valve and other safety valves in use at that time. On locomotive and other quick-steaming boilers the old safety valve served little other purpose than to warn the attendants that the pressure was getting dangerously high, when they took means to assist the safety valve in reducing it. This was particularly true of boilers under motion, where, for obvious reasons, the valve must be spring-loaded, and the spring opposed increased tension so soon as the valve began to leave its seat; but it was measurably true of safety valves as applied to all classes of boilers. One of Richardson's valves of only a fractional part of the area of the old valve

would prevent the possibility of increasing the pressure in a boiler, even with the hardest firing, when the old valve would permit the accumulation of a dangerous pressure under ordinary firing. This was repeatedly demonstrated, and is of interest as showing what Richardson gave to the public in his valve. By regulating the stricture between the annular chamber and the atmosphere, by which the pressure in the chamber (always, of course, less than boiler pressure) would be correspondingly regulated, the valve could be made to close upon any desired reduction of boiler pressure—as little as one-half pound per square inch with boiler pressure 125 pounds. Briefly stated, Richardson's valve permitted keeping the pressure in a boiler substantially constant, effectually avoiding all danger of disaster by higher pressure, and loss from excessively reducing the pressure through the safety valve.

Richardson's valve almost immediately went into extended use, especially on locomotives. From the peculiarly impulsive manner in which it began and ceased to blow, railroad men gave it the name of "pop" valve, a name by which it is now generally known.

In 1869 another patent was granted to Richardson, relating particularly to means for easily and exactly regulating the stricture previously referred to. It may be noted that this stricture must bear definite relations to other details, and hence the importance of being able to change it to suit a possible change in other conditions, or to bring about different results in the blowing of the valve.

In the meantime, the mechanical and commercial success of Richardson's valve being assured, attempts at evasion of his patents followed as a matter of course. The basis for this was finding that previous to the date of his first patent, efforts had been made—notably in England—to construct a valve that should accomplish what Richardson's valve accomplished, and that several patents upon such valves had been issued in England; one, at least, of these English inventors had patented his valve in this country. Nothing, generally speaking, was known about these valves, because, utterly failing in their purpose, they never passed beyond the experimental stage. Several—perhaps all—of them would prevent the accumulation of steam beyond the point at which they were set to blow, but having begun to blow, they would continue it until the boiler pressure was reduced from twenty to fifty per cent. This rendered them not only valueless, because they would reduce the pressure below that required to do the work, but extremely wasteful of steam, and dangerous in that they would submit the material of the boiler to sudden and damaging changes of temperature. These valves possessed one feature in common with Richardson's, viz., a surface for the steam to act upon after leaving the ground joint. But they lacked the stricture that should confine the steam just sufficiently to overcome the increased tension of the spring, but not sufficiently to prevent the spring from promptly closing the valve upon a slight reduction of the pressure in the boiler.

This stricture, the life of the whole matter, had escaped the attention of previous inventors, but was fully comprehended by Richardson, and in the first valve made by him was the point considered when he desired to slightly change its operation. The writer speaks of this from personal knowledge.

So far as utility as a safety valve adapted for use on a boiler furnishing steam regularly, as for a steam engine, was concerned, valves constructed after these English patents were just about as valuable as a plug so fastened in the boiler shell that if a certain pressure is exceeded it will blow out and empty the boiler of steam. And a point of particular interest to inventors is whether Richardson, having made a safety valve as nearly perfect in its action as any mechanical device can be expected to be, could be deprived of his rights and property in the invention *because of the failures of others to do the same thing.*

It was soon found by those who sought to evade Richardson's patents that, by additions in the light of his achievements, valves constructed after some of the rehabilitated English patents could be made to work with reasonable satisfaction; and not long after the introduction of Richardson's valve, E. H. Ashcroft began to manufacture safety valves under a re-issue of one of these (Naylor's) patents, claiming that Richardson's patents were subordinate to Naylor's. The result of this was expensive litigation, lasting until 1878, when the validity of Richardson's patents as against those of Naylor was fully established. Soon after the decision affirming this, a consolidation of the interests of Richardson with those of Ashcroft was made, and the present Consolidated Safety Valve Company formed.

Early in 1879 this company brought suit against the Crosby Steam Gage and Valve Company, who were manufacturing safety valves under two patents granted to Crosby in 1875. The company representing Richardson's interests was defeated in the lower courts, the resurrected English patents being successfully used against them. According to the decisions of this court it appeared that, although Richardson had made an invention of great practical utility to the public, he was entitled to property in it only in the particular form in which he had constructed it; that by a change in this respect—a reversal in the position of important parts—anyone could use Richardson's invention.

An appeal was taken, when, as intimated at the beginning of this, the decision of the lower court was reversed by the Supreme Court.

This decision is of importance to those interested in the manufacture, sale or use of safety valves, but its general value is in establishing a precedent that will undoubtedly be of great future benefit in preventing useless patent litigation. C. A. Moore, president of the Consolidated Safety Valve Company, who insisted upon fighting this suit through to the end on a basis that should fully determine whether Richardson could be deprived of his rights by something never made till he made it, is entitled to a good deal of credit for the establishment of a precedent that is a valuable addition to the knowledge of the rights of inventors, as these rights are likely to be interpreted by the Supreme Court.

The opinion of the court, as delivered by Mr. Justice Blatchford, is eminently plain and common sense, within the understanding of ordinary readers unversed in legal literature. We have room only for brief extracts, which, however, will give a good idea of the reasoning upon which the decision was reached. He says, speaking of the English patents adduced against Richardson's original patent:

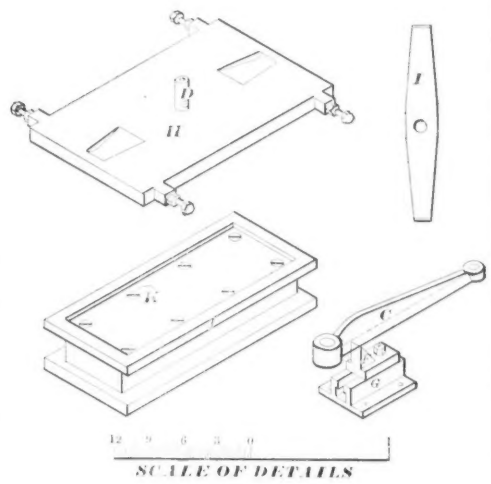
* * * It may be generally said that they never were in their day and before the date of that patent, or of Richardson's invention, known or recognized as producing any such result as his apparatus of that patent produced. * * * Likenesses in them in physical structure to the apparatus of Richardson in important particulars may be pointed out, but it is only as the anatomy of a corpse resembles that of the living being. The prior structures never effected the kind of result attained by Richardson's apparatus, because they lacked the thing which gave success. * * * Taught by Richardson, and by the use of his apparatus, it is not difficult for skilled mechanics to take the prior structures and so arrange them as to produce more or less of the beneficial results first made known by Richardson; but, prior to 1866, though these old patents and their descriptions were accessible, no valve was made producing any such results.

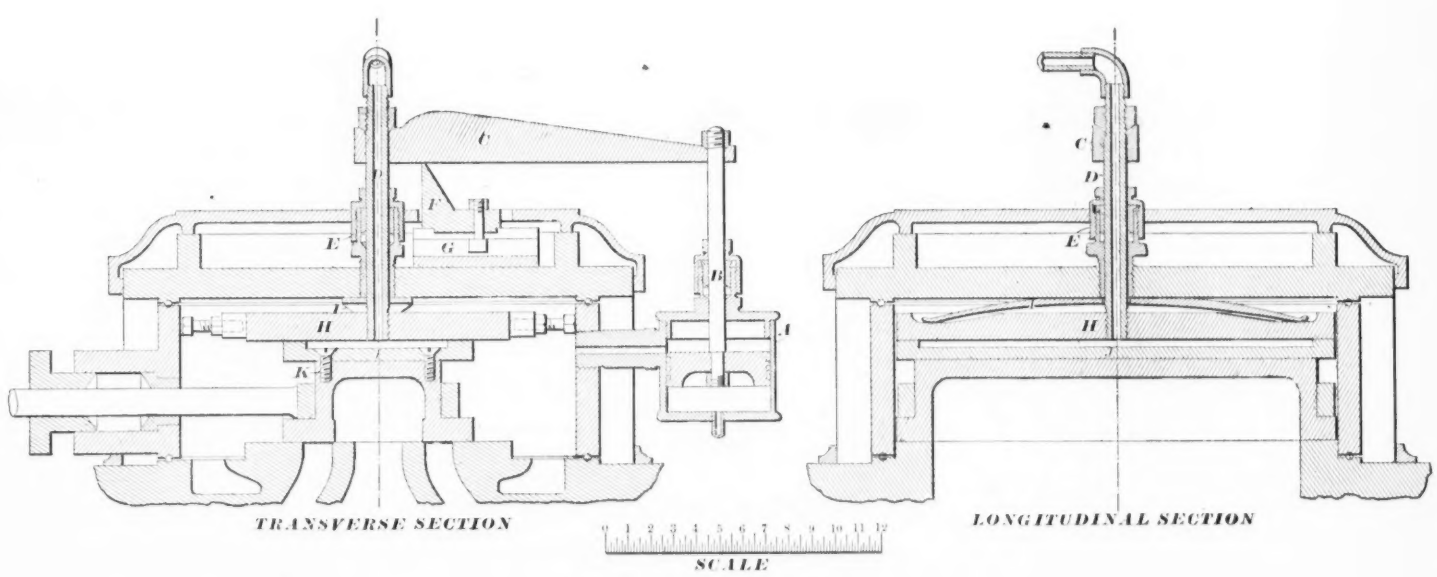
* * * * * *

It appears to have been easy enough to make a safety valve which would relieve the boiler, but the problem was to make one which, while it opened with increasing power in the steam against the increasing resistance of a spring, would close suddenly and not gradually by the pressure of the same spring against the steam. This was a problem of the reconciliation of antagonisms, which so often recurs in mechanics, and without which practically successful results are not attained. What was needed was a narrow stricture to hold back the escaping steam, and secure its expansive force inside of the lip, and thus aid the direct pressure of the steam from the boiler in lifting the valve against the increasing tension of the spring, with the result that, after only a small, but a sufficient, reduction in the boiler pressure, the compressed spring would, by its very compression, obtain the mastery and close the valve quickly. This problem was solved by Richardson, and never before.

* * * * * *

Richardson's invention brought to success what prior inventors had essayed and partly accomplished. He used some things which had been used before, but he added just that which was necessary to make the whole a practically valuable and economical apparatus. The fact that the known valves were not used, and the speedy and extensive adoption of Richardson's valve, are facts in harmony with the evidence that his valve contains just what the prior valves lacked, and go to support the conclusion at which we have arrived on the question of novelty. When the ideas necessary to success are made known, and a structure embodying those ideas is given to the world, it is easy for the skillful mechanic to vary the form by mechanism which is equivalent, and is, therefore, in a case of this kind an infringement.




McDERMOTT'S BALANCED VALVE.

### The McDermott Balanced Valve.

The annexed engravings show the arrangement of the McDermott balanced valve so clearly that a detailed description is unnecessary. A pressure or relief plate, *H*, is used, which is connected by a hollow stem to one end of a lever, *C*, the other end of the lever being connected with a small piston. The lever, *C*, is supported by a small movable fulcrum, *F*, to enable adjustment according to the relative pressure areas of the relief plate and balancing cylinder. The hollow stem serves useful purposes in draining the cavity under the valve, and, when leakage takes place, it shows the engineer just how much steam is being lost. The valve has been applied to several engines made under the supervision of the patentee, Mr. P. M. McDermott, who is superintendent of the Milburn Machine and Gin Company, Memphis, Tenn., and it is exhibited at the New Orleans Exhibition in the exhibit of Young & Zerbe, Cincinnati.

### Inquiries from National Bureau of Education About Apprentices.

A circular of inquiry, sent out by the Bureau of Education, Washington, contains the following questions:

1. Name of employer or officer making return.
2. Name and location of establishment.
3. Total number of skilled workmen (journeymen) generally employed at one time.
4. Have you in your employment any indentured apprentices? How many? For what period bound?
5. Have you any other apprentices? How many?
6. What advantages do you believe the apprentices derive from completing the full period of apprenticeship?
7. Is the number of apprentices you keep controlled by the regulations of any trade organization to which your journeymen belong? If yes, what would be the proportion of apprentices to your journeymen, in the absence of any such regulations?
8. What is the length of apprenticeship period either stipulated or customary?
9. Are apprentices instructed in all branches of their trade? If not, please give a general idea of what is attempted in this direction?
10. Do apprentices receive any considerable amount of direct instruction or are they obliged to rely mainly upon themselves in gaining a knowledge of the trade.
11. What means of becoming acquainted with the scientific principles underlying their trade are provided in your locality by evening schools, municipal or other?
12. Is any supervision exercised over your apprentices beyond the hours of their employment?
13. Do you find any difficulty in providing yourself with good mechanics? If so, to what do you attribute it?
14. What proportion of your highly skilled workmen are of foreign birth and training?
15. Please add any general remarks which in your judgment the subject calls for.

## Feeding Boilers at the Bottom.

*From* THE LOCOMOTIVE, *published by the Hartford Steam Boiler Inspection and Insurance Company.*

One of the most important things to be considered in boiler construction is the position and arrangement of the feed apparatus, but it is, unfortunately, one of the elements that is most often overlooked, or, if considered at all, only in a very superficial manner. Many seem to think that it is only necessary to have a hole somewhere in the boiler—no matter what part—through which water may be pumped, and we have all that is desired. This is a very grave error. Many boilers have been ruined, and (we make the assertion with the confidence born of long experience) a large number of destructive explosions have been directly caused by introducing the feed water into boilers at the wrong point.

On the location and construction of the feed depends to some extent the economical working of a boiler, and, to a great extent, especially with certain types of boilers, its safety, durability, and freedom from a variety of defects, such as leaky seams, fractured plates, and others of a similar kind. And it is unfortunately true that the type of boiler which from its nature is most severely affected by mal-construction, such as we are now speaking of, is the very one which is the oftenest subject to it. We are speaking now more particularly of the plain cylinder boiler, of which there are many in use throughout the country.

Plain cylinder boilers are, as a rule, provided with mud drums located near the back end. As a rule, also, these boilers are set in pairs over a single furnace, and the mud drum extends across beneath and is connected to both, and one end projects through the setting wall at the side. Our illustrations show a typical arrangement of this kind. Fig. 1 shows a transverse section of the boilers and setting, while Fig. 2 shows a longitudinal section of the same. It is a favorite method to connect the feed pipe *F* to the end of the mud drum which projects through the wall, and here the feed water is introduced, whether hot or cold, and there is really not so much difference after all between the two, for no matter *how* effective a heater may be, the temperature to which it can raise water passing through is quite low compared with the temperature of the water in the boiler due to a steam pressure of say eighty pounds per square inch. The difference in the effect produced by feeding hot or cold water at the wrong place is one of degree, not of kind.

When a boiler is under steam, of, say eighty pounds per square inch, the body of water in it will have a temperature of about 324 degrees Fahr., and the shell plates will necessarily be somewhat hotter, especially on the bottom (just *how* much hotter will depend entirely upon the quantity of scale or sediment present). Now introduce a large volume of cold water through an opening in the bottom, and what becomes of it? Does it rise at once, and become mixed with the large body of water in the boiler? By no means. It *cannot* rise until it has become heated, for there is a great difference between the specific gravity of water at 60°, or even 212° Fahr., and water at 324°. Consequently it "hugs" the bottom of the boiler and flows toward the *front* end, or hottest portion of the shell. Now let us examine the effect which it produces.

We know that wrought iron expands or contracts about 1 part in 150,000 for each degree that its temperature is raised or lowered. This is equivalent to a stress of *one ton* per square inch of section for every 15 degrees. That is, suppose we fix a piece of iron, a strip of boiler-plate, for instance, ¼ of an inch thick and 4 inches wide, at a temperature of 92 degrees Fahr., between a pair of immovable clamps. Then if we reduce the temperature of the bar under experiment to that of melting ice, we put a stress of four tons upon it, or one ton for each inch of its width.

Now, this is precisely what happens when cold water is fed into the bottom of a boiler. We have the plates of the shell at a temperature of not less, probably, than 350° Fahr. A large quantity of cold water, often at a temperature as low as 50° Fahr., is introduced through an opening in the bottom, and flows along over these heated plates. If it could produce its *full* effect at once the contraction caused thereby would bring a stress of $300 \div 15 = 20$ tons per square inch upon the bottom plates of the shell. But fortunately it cannot exert its full effect at once, but it *can* act to such an extent that we have known it to rupture the plates of a new boiler through the seams on the bottom *no less than three times in less than six weeks* after the boilers were started up.

The effect in such cases will always be the most marked, especially if the plant is furnished with a heater, when the engine is not running, for then, as no steam is being drawn from the boilers, there is comparatively little circulation going on in the water in the boiler, and the water pumped in, colder

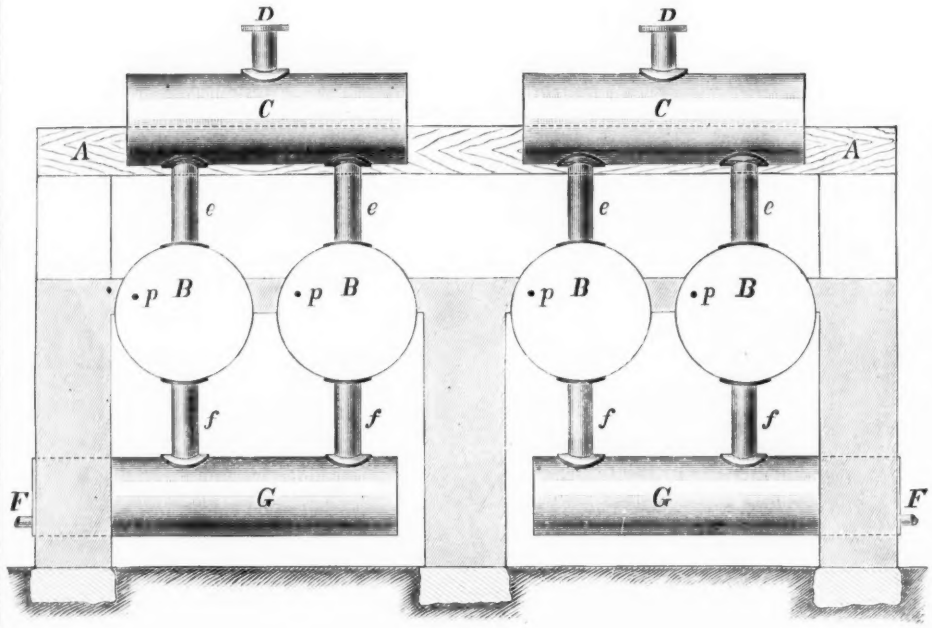



FIG. 1.

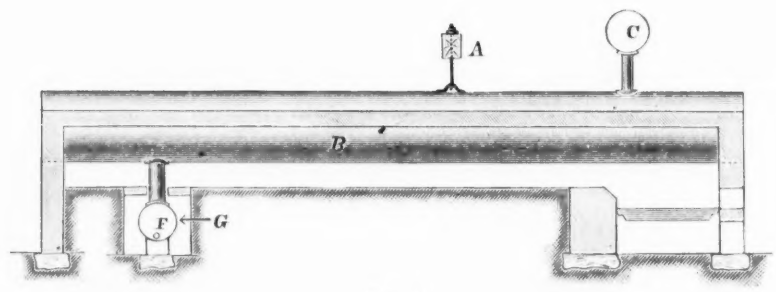



FIG. 2.

than usual from the fact that the heater is not in operation, spreads out in a thin layer on the lowest point of the shell, and *stays there*, and keeps the temperature of the shell down, owing to the fires being banked or the draft shut, while the larger body of water above, at a temperature of from 300 to 325 degrees, keeps the upper portion of the shell at *its* higher temperature. It will readily be seen that the strain brought upon the seams along the bottom is something enormous, and we can understand why it is that many boilers of this class rupture their girth seams while being filled up for the night after the engine has been shut down. To most persons who have but a slight knowledge of the matter, we fancy it would be a surprise to see the persistence with which cold water will "hug" the bottom of a boiler under such circumstances. We have seen boilers when the fire has been drawn, and cold water pumped in to cool them off, so cold on the bottom that they felt cold to the touch, and must consequently have had a temperature considerably below 100° Fahr., while the water on top, above the tubes, was sufficiently hot to scald; and they will remain in such a condition for hours.

The only thing to be done where feed connections are made in the manner described, is to change them, and by changing them at once, much trouble, or even a disastrous explosion, may be avoided. Put the feed-pipe in through the front head, at the point marked *p* in Fig 1, drill and tap a hole the proper size for the feed-pipe, cut a long thread on the end of the pipe and screw the pipe through the head, letting it project through on the inside far enough to put on a coupling, then screw into the coupling a piece of pipe not less than eight or ten feet long, letting it run horizontally toward the back end of the boiler, the whole arrangement being only from 3 to 4 inches below the water line of the boiler, and hot or cold water may be fed indifferently, without fear of danger from ruptured plates or leaky seams. In short, put in a "top feed," and avoid further trouble.

## Curious Air-Brake Troubles.

From the machinist in charge of repairing the Westinghouse air-brake apparatus at the Renovo shops of the Pennsylvania Railroad, we learned the particulars of two cases where the brake had failed from causes that we had not previously met with. One day he overhauled an air-pump, and among other repairs put new bushings in the valve chambers. When the job was completed, he found the pump would not work. He took the whole thing apart and inspected every piece, making sure that the fits were all accurate and the steam passages all clear; and nothing was found to account for the machine failing to operate. It was accordingly put together again and tried with the same result as at first. Not a stroke would the pump make. This was discouraging, but the job was in the hands of a man not easily beaten, and fully impressed with the truth that something was wrong, otherwise the pump *must* work. It is needless to follow the details of the search for the obstacle, suffice it that he found the pump casting had been corroded where the reversing valve bushing was screwed, in permitting a small leak of steam to pass through which was sufficient to prevent the main valve from rising.

An amusing failure of the air-brake happened to an engine that came in to the same shops. It was found when the engine was taken out to her train at the other end of the division, that the air-pump would not compress any air in the reservoir. The pump seemed to work all right, but no pressure resulted from its operations. The engineer could not find anything wrong, and the train had to be braked during the trip by hand. When the engine arrived at Renovo, the machinist who looked after the air-pumps was called out to discover the disorder. He tried the pump, and knew that it was pumping air, for he could feel the air going in at the suction strainer. He went below and examined the connections, following the pipes to the end of the tender, expecting to find a leak, but nothing of the kind was there. The case was puzzling, but he knew that air could not be drawn into the pump without being expelled somewhere, so he returned to the search. One pipe led to the front of the engine, for use in cases where the engine had to run backing. On following this pipe he found the stop cock open and the air passing out as fast as it was pumped. These cases were mentioned to the writer as troubles not mentioned in an article published in the AMERICAN MACHINIST, two years ago, on "Air-Pump Disorders."

## A Lost Industry.

Jay Gould, the railroad magnate, takes pleasure in letting the world know that twenty-five years ago he earned money by honest industry, making noon marks for farmers. Work of that kind done only a quarter of a century ago indicates what a short way in time we are removed from the use of crude, ancient devices. It is only within half a century that the admirable mechanical methods of American clockmakers have brought the price of time-pieces so low that it would not pay to go round offering to make noon marks. The noon mark was an humble brother of the sun dial, which was a crude method of indicating time compared to the cheapest modern time-piece; yet the dial was considered a great invention in its day, and the Babylonians were honored for originating such a boon to mankind. The sun dial might have still remained the leading rural time indicator but for the persistence of Connecticut clockmakers in underselling the world. When they succeeded, by the interchangeable stamping process of manufacture, in finishing serviceable clock-works for twenty-five cents each, the occupation that gave Jay Gould his financial start was gone for ever.

Colonel Boise, president of the Dickson Manufacturing Company, Scranton, Pa., has invented a car-wheel which is undergoing trial in train service. The body of the wheel is of mild steel, and consists of two plates, which are formed under a hydraulic press. When bolted together, they hold a central cast-iron hub in position, and their outside edges grasp a projection rolled inside the tire, which is of steel. The wheel possesses the attributes of durability and strength, and ought to be comparatively cheap.

## Velocity of Projectiles.

An interesting lecture, illustrated by experiments, was recently delivered by Henry A. Sinclair, electrician, on the velocity of projectiles. A Boulenge chronograph, an instrument used in astronomical investigations, and in this case adapted to measuring the velocity of projectiles, was used to show how accurately high speed could be measured. The instrument, as arranged, consisted of an upright brass tube supporting two electro magnets one above the other. When a test was being made an electric wire connected one of the magnets with the point of firing, while the other magnet was connected with the target or objective point of the projectile by similar means. A long rod was suspended from the first magnet and a short rod from the second one. When the ball left the pistol that was used in the trial, it cut the first wire, breaking the circuit, releasing the long rod, which dropped down. When the ball struck the target the

second wire was broken, and the short rod fell, striking a spring, which caused a knife blade to strike the descending long rod. The space from the base of the long rod to the mark made with the knife was then measured and a simple calculation based on the laws of falling bodies showed the time the ball was in passing from the muzzle of the pistol to the target. The same system is used in ordnance practice to ascertain the speed of the projectiles fired by heavy guns.

During the course of the lecture Mr. Sinclair explained that ever since the year 1740 artillery engineers have been trying to measure the velocity of projectiles, and it was only within the last few years that the system has been perfected. In 1840 electricity was first used for the purpose. Instruments are now made that can measure from 30 seconds to the one five-thousandth part of a second. Grains of powder used for ordnance purposes were exhibited, some of them as large as a hen's egg. The lecturer said that guns had been tested at Sandy Hook up to 107,000 pounds to the square inch. The average pressure on a gun was about 40,000 pounds to the square inch. The velocity of projectiles from large guns ranges from 600 to 2,400 feet per second.

## Foote's Nut Arbor.

Those who have had experience in the use of nuts where it is particularly requisite that the face shall be true with the thread, will admit that they do not often fulfill that condition; everybody will as readily admit that all nuts should do so. Looking at the matter in this light, Geo. B. Foote, of Helena, Montana, has devised a nut arbor which he claims will not only square every nut absolutely true with the threads, but by the aid of which double or more work can be done than with the ordinary nut arbor. The engravings very clearly represent his device. Of these, Fig. 1 is a longitudinal section, Fig. 2 a front view of friction wheel, Fig. 3 a side view of relieving collar, Fig. 4 a side view and part section of oscillating shoulder piece, and Fig. 5 a side view of the threaded end of arbor.

In these, *A* is the arbor, and *B* the shoulder piece against which the nuts to be faced are screwed. The piece *B* is first tapped out to fit the arbor, one side faced up true and the other turned semi-spherical, the center being at *x*. All the threads but one are then bored out, and the hole beveled as shown.

The collar, *C*, against which the back part of *B* bears, is fitted so as to slide a short distance, longitudinally, on the arbor, the provision for which, and the manner of holding it against turning on the arbor, being shown at *F*, *f*.

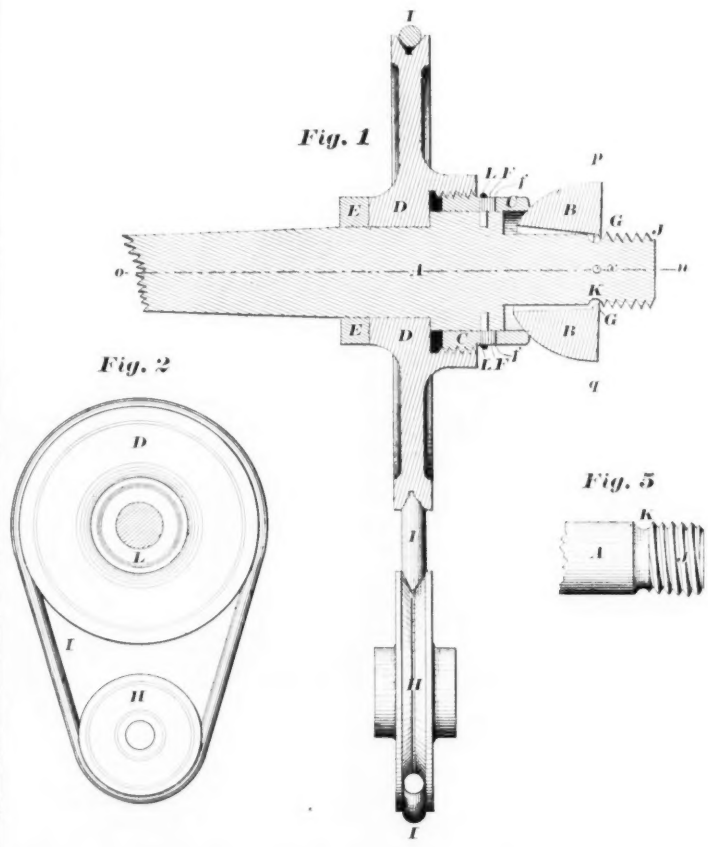
The friction wheel, *D*, is fitted to be turned a few times on the arbor, and, abutting against the fast collar *E*, when it is turned it will traverse the collar *C*, as clearly indicated.

The shoulder piece, *B*, is screwed over the threads of the arbor until its single thread is in the groove, *K*, at the termination of the thread.

The arbor is fitted to the spindle of a lathe or machine provided with a go-ahead and backing motion. The lathe being started ahead, for a few revolutions of the arbor *A* the friction wheel *D* is held stationary by means of the friction device, consisting of belt *I* passing around the stationary pulley *H*; this throws the collar *C* forward as far as the slots *f*, *f* will permit, when the wheel *D* will revolve with the arbor. The nut to be faced being screwed up to the shoulder piece *B*, the latter will oscillate against the collar *C* until it has assumed a position in which the axis of the thread is coincident with the axis of the arbor, in which position it will be held for squaring up. Then the lathe is reversed, and the wheel *D* held stationary for a few revolutions, which withdraws collar *C*, leaving piece *B* and the nut loose on the arbor, so that a slight touch on the nut will run it off; and the arbor is free for repeating the operation.

## Pennsylvania Railroad Shops at Renovo.

The travelers who go out in search of America's picturesque scenery, miss their aim when they fail to visit the beautiful valleys and mountain glens traversed by the western branch of the Susquehanna River. The Philadelphia & Erie Railroad, a portion of the great Pennsylvania Railroad system, follows this beautiful river a long distance. Many attractive scenes pass under the eye as the traveler speeds westward. Among the spurs of the Alleghenies, in a valley that seems surrounded on every side with pine-clad hills, we find Renovo, a town like Altoona and Crewe and other well-known cities, owing its importance and even existence to the fact of its being the mechanical headquarters of a railroad. Renovo receives no support from outside. There is no agricultural population driving in their produce to this place, for the rugged hills around provide no land for settlers, and the occasional log hut of a solitary lumberman is the only human habitation found amidst the wooded solitudes. Deer and bears still find safe retreats amidst the fastnesses provided by nature, and the brooks around give good sport to the angler who has the skill to lure speckled trout into his basket.




The fortunes of Renovo center on the railroad shops, where all the repairs and some new work is done for the rolling stock of the Philadelphia & Erie Railroad. Mr. W. L Holman is resident master mechanic, who exercises supervision over the whole of the works. He is aided in performing his duties by a most efficient and zealous staff of foremen and assistants. As might be supposed from the nature of their surroundings, the railroad men are thrown very much upon themselves for amusement outside of working hours, and the whole staff appears to hold exceedingly cordial relations together.

After spending two days among the officers and men belonging to the Renovo shops, we were strongly impressed with the ardent desire that prevails all round to make the work done in these shops second to none produced in any part of the Pennsylvania Railroad system; and of the anxiety to maintain the prosperity and prestige of the town of Renovo. In all the shops a very exacting contract system of doing work is carried on, and the employes do more work for the pay they receive than I have ever before seen men do in any shop in any country; but the incessant toil is carried on cheerfully, because that, they believe, is the only way to retain work at Renovo.

In nearly all the shops belonging to the Pennsylvania Railroad Company, the piece system of doing repair work is in vogue. The prices vary in the different shops, the facilities for producing work quickly being varied through the kind of tools in use, and other circumstances. The details of the system followed in the machine shop at Renovo have been worked out with great care and skill, and the work produced under it ought to be gratifying to the railroad company. Before the system was introduced, Mr. A. Dolbeer, the foreman of the shop, went carefully over a list of operations that embraced as nearly as possible every job done in the shop, and put down what he considered a fair price for doing every piece of work. Then he called in his gang foremen, and went over the work each man was looking after, and discussed prices with him, till the list was made as nearly complete as possible.

The men are all rated to receive day pay according to the current price paid for the work they can do, and they are subject to shop rules of coming in and leaving the works, just the same as ordinary day mechanics. When a man is sent to do work, he is required to fill up a slip giving particulars of the job done and the time it took. This has to be endorsed by the gang boss and the inspector of work, and forms the data from which the man is paid. He is paid merely the rate value of the job done without consideration of the time he worked at it, the time being merely given to indicate the relative expense of the work by day pay. Each operation on one piece of work is rated separately, and paid accordingly. Take a new side rod, for instance, of a particular class of engine. We have planed to size, fileted in milling machine, body of rod ground and polished, brasses planed, brasses fitted to strap, etc. Different workmen have been employed on these operations, and each man sends in an account of the work he has finished. It is the same with the facing of valves, boring cylinders, fitting shoes and wedges, or any part of the numerous details of mechanical labor represented in the rebuilding of a locomotive, repairing a tender, a passenger car, a freight car, or in making a crossing frog or a station signal. Sometimes three or four men will be employed on one job, and in this case they are paid a proportion of its value, according to their rate of day pay and the time each man was engaged upon it.

The system has a tendency to sub-divide work, and keep men repeating operations at which they quickly become very proficient. This, and the impetus to hard work engendered by increase of earnings following increase of industry, make men turn out an astonishing quantity of work. Strict inspection is rigidly kept up to reject inferior work and prevent its production, and the character of the work done compares favorably with that of ordinary day shops. Yet the work costs the company only about half the price that would be paid in a shop where men were paid by the day. A mechanic does not reap the benefit due to the increase of work due to the skill of repetition and hard work. So soon as it is found that unusually good pay can be made on a particular operation, the price is cut down. At Renovo the cutting-down only occurs once a year, but at some of the company's shops reductions are made every month where they can be carried out. The men, as a rule, make about twenty per cent. more pay than they would receive for day work, but they do more than double labor; yet the greater part of them are fairly contented, and seem to think theirs is the only way to keep Renovo prosperous.

This system obliterates the inferior, slow mechanic, but does not do justice to the rapid, accurate hand, who occasionally springs up in the machine shop, a giant among workmen, conspicuous in skill, as Goliath of Gath was physically among mortals. This man can take a bold, deep cut on a shaft, and do his work true every time, and be finishing when an ordinary man is beginning his second cut. He starts a drill through a rod four inches deep, and comes out true to a line every time as if by intuition. He has got his crosshead lined true when the man working opposite is changing the liners of his guides. The pay that will keep this man down to three dollars a day will starve the other machinists, and the lightning man is kept down to avoid demoralizing the shop.

Most of what is understood to be laborers' work is done here by contract. Engines are jacked up and the wheels taken from under at schedule rates; regular prices are paid for taking off old tires and putting new ones on, and the price struck us as being ridiculously low. We saw two laborers start to take out a pair of cylinders that were used up and had to go to the scrap heap. The bolts fastening the cylinders to the smoke-box were cut when we got round. These two men disconnected the frames at the middle joint, ran the cylinders and frames out, turned them over with a crane, drove out the frame fastenings, and had the cylinders in the scrap heap within three hours. In the cellar below the machine shop there are several grinding wheels located. Here a man is at work finishing car axle boxes. He carries on four distinct operations at once. The lid face of the box is ground by a reciprocating emery wheel, which passes and re-passes over the face, and the workman places the box so that this operation will be properly done. While the grinder is going on box No. 3, box No. 2, that preceded it, is under a drill press, watched by the same man, who sees that an automatic feeding drill makes the holes for the lid hinge. While that work is progressing, the workman rivets the lid on box No. 1, which he had previously moved from the drill press. His operations were not that of a deliberate workmen. They rather resembled the tumult of a boat's crew throwing cargo overboard to keep the craft from sinking. He hammered the hinge rivet with all his might, jumped to the grinder and jerked out a box, putting another one in, hurried to a bench with the ground box, clamped a lid upon it, ran back the drill and moved out the box from the drill press, then jerked the other one in and started the drill going. This seemed to leave him only about ten seconds to rivet the lid on and get back to the grinding machine on time, but he always succeeded in making close connection.

In ancient times, in the barbarous ages of the world, when heavy burdens were put upon men and their masters wanted to get more than a fair day's work, taskmasters were put over the men, who beat the toilers when the tasks were not accomplished. Modern civilization follows more refined methods. The pay-sheet is made the taskmaster, and small pay the lash. They seem to do their work quite as effectually. Whether or not it will lead to an exodus is another matter; but it is to be hoped, should dis-

content arise, that the communist and anarchist will not be chosen as leaders to a promised land.

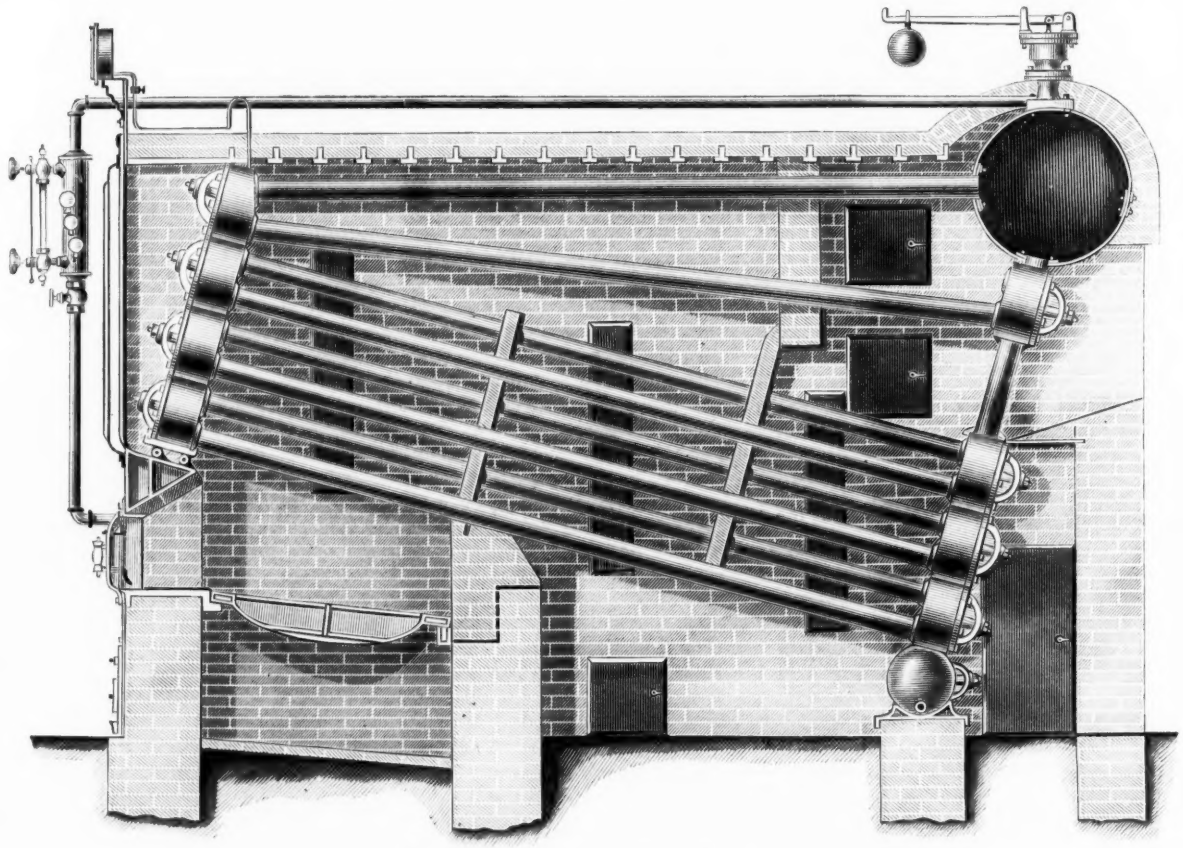
Carrying on this contract system entails a great deal of clerical work, and requires the attention of numerous gang bosses and work inspectors. But the work is carried on very systematically, and all operations move forward promptly and smoothly. In repair work, the foreman must necessarily exercise a great deal of discretion respecting prices. A job will sometimes turn up that has never been done before, and he can estimate what it is worth and offer it at the price he considers fair. Another job will turn out much harder to do than was anticipated—will take three or four times the work and time to finish it that previous jobs of the same kind had taken. The foreman is empowered to use his own discretion in allowing extra pay in such cases. This discretion seems to be exercised wisely and well, which may to some extent account for the abiding faith the men express in persistently holding that the Pennsylvania Railroad Company, as represented by the Philadelphia and Erie branch, is the greatest corporation in the world, and that their machinery is considerably ahead of anything in creation.

## Zell's Safety Water Tube Boiler, with Single Drum.

In our issue of April 12, 1884, we illustrated this boiler as made with a double drum. This week we present an engraving representing it as made with a single drum, in which form it is made in sizes from 30 to 70 horse-power, the double drum form being used for larger sizes.

Features of this boiler, not referred to in our previous description, are: The cast-iron arch over the furnace door, through which a circulation of cold air is maintained. This avoids the expense and trouble of the frequent renewal of brick arches which is necessary in the common setting.

The fronts are of wrought iron, with cast-iron trimmings; they are light to handle, keep their shape, and do not crack or break.



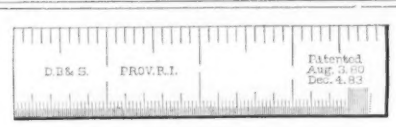
ZELL'S SAFETY WATER TUBE BOILER.

When erected, the boiler rests on two saddles at the back, which are stationary, while at the front the weight rests on a plate, under which are rollers. The rollers rest on the arch box. The boiler is thus set quite independently of the brick work, permitting free expansion without cracking the walls.

The hollow cast-iron bridge wall box connects hollow grates with hot air flues, giving an uninterrupted current through the bars, increasing the draft.

This boiler is manufactured at the Pioneer Iron Works, Brooklyn, N. Y. The New York office is at 22 Cortlandt Street, L. B. Eaton, agent.

Petroleum waste, it is said by the *London Spectator*, is being extensively used on Russian railways. The petroleum, after a few day's exposure to the air, is used with entire safety. Coal is high in price, and the petroleum costs very much less as fuel. It is also used on steamers, where it saves the expense of stoking, firing with it requiring almost no attention at all. It is also cleaner to use and makes no smoke. The *Standard* believes that while petroleum will not be likely to supersede coal in countries where the latter is abundant, that it exists in places where coal is obtained only at great cost. It is also important in ocean navigation that weight for weight, petroleum goes about three times as far as coal.




## Improvement in Graduated Scales.

Darling, Brown & Sharpe, Providence, R. I., have made an important improvement in the graduation of standard scales by which measurements can be readily made, and dividers set, by thousandths of an inch. The following, from their special circular, explains the improvement:

"The improvement consists in making in a scale of hundredths (preferably near the end), nine spaces of eleven-thousandths ($\frac{11}{1000}$) of an inch each, and a diagonal line of points or dots, the point nearest the edge of the rule being twelve-thousandths from the last line, the second point thirteen-thousandths, and so on, each point being one-thousandth of an inch further from the line than the point preceding it.

By the addition of the nine ($\frac{11}{1000}$) spaces, measurements can be made and dividers set by thousandths of an inch, from one-tenth of an inch to any length on the scale of hundredths; and with the addition of the nine ($\frac{11}{1000}$) spaces and line of points, dividers can be set by thousandths, from one-hundredth of an inch to any part of the scale.

*Examples:*—To set dividers thirteen-thousandths of an inch, place one point of the dividers in the second dot and the other point in the last line. To get $\frac{75}{1000}$, take two hundredths and five of the ($\frac{11}{1000}$) spaces. To get one inch and one thousandth, take ninety-nine hundredths and one of the $\frac{11}{1000}$) spaces. To get $\frac{575}{1000}$, take fifty-two hundredths and five of the ($\frac{11}{1000}$) spaces.

## That Rotary Snow Shovel.

During the heavy snow blockades on Western railroads throughout the winter we have been expecting to hear of the rotary snow shovel we illustrated last September taking a part in clearing away the obstructions to travel. We now learn that, owing to the introduction of some important improvements upon the original machine, unexpected delay was experienced in getting a machine ready for construction. In the original machine the snow could be thrown only to one side, but the improved one permits of the snow being thrown either way. As the rotary snow shovel is a very expensive piece of machinery, the owners did not wish to bring it out till all the details were properly perfected. A machine that has the snow-cutters and fan operated by a double-cylinder engine, 17×22 inches, with a boiler to supply the necessary steam, is now under construction at the Cooke Locomotive Works, Paterson, N. J., and will be ready for work about the time this paper appears. It will be shipped at once to Chicago, and put to work on one of the snow-obstructed roads.

## Work of Schools of Mines.

The territory of Dakota is striving to establish a school of mines, and Prof. Bailey has been helping the cause by a series of interesting articles on the subject contributed to the Rapid City *Republican*. In the course of one article he says: "A school of mines not only gives the student an opportunity to learn the broad principles of geology, chemistry and metallurgy, the principles of mining and the economic extraction of ore, and the best methods of treating the ores extracted, but it investigates for the miner the machines and methods best adapted to his locality. Its corps of teachers and graduates are studying the geology of the regions near them, and making the work of the miner lighter each year. They stimulate the search after new deposits; they promote increased productions, and find new uses for the products. Not only this, but such a school bestows a variety of benefits upon the people in general. The popular cry to-day is for practical education, for speedy and tangible results. The primary and most essential principle of education is to afford training for future use, and its results must not lie too far distant or be too obscure and uncertain in their working out. That knowledge is of most worth that will best prepare men for complete living. An education which leads to no results commensurate with the cost and pains bestowed upon it is like a road described in Longfellow's 'Hyperion,' which, after leading over pleasant hills, through smiling meadows and shady woods, narrows at last into a squirrel track and runs up a tree. The education offered by a school of mines is pre-eminently practical."

## Claim of Extraordinary Tractive Power.

We have received the details of work alleged to have been performed by engine No. 10, belonging to the Locomotive Improvement Company, of Toledo, Ohio., with the question what we think about it. The engine, which is an ordinary eight-wheel engine, with cylinders 18x24; driving-wheels, 57″ diameter, and carrying a boiler pressure of 140 pounds, and is equipped with a traction increaser, is said to have pulled a train weighing over 600 tons up a grade 70 feet to the mile, 16 miles long, in 1 hour and 18 minutes. What we think about the matter is, that the work was not done. Some mistake has been made with the steepness of the grade or with the weight of the train, probably the former. A draw-bar tension of at least 18,000 pounds would be necessary to take that train up the grade in question, and the engine would not develop more than 15,000 pounds with a mean piston pressure of 110 pounds to the square inch. We cannot conceive any way in which 15,000 pounds can turn the scale against 18,000 pounds.

## LETTERS FROM PRACTICAL MEN.

### Increasing the Face of Spur Gears, Keeping the Arms in Center.

*Editor American Machinist:*

I have found the following a simple way to increase the face of spur gears and keep the arms in the center of rim. Almost every moulder knows how to make a gear with a face wider then the pattern that it was made from by adding all that the pattern is drawn to one side; in that case the arms are out of center, or nearer to one side of the gear than to the other. This job can be made in a flask or in the foundry floor. I will describe the way to make the job in the floor, it being the most difficult to start.

In starting the job the moulder gets four short stakes, say 6″ or 8″ long, and drives them in the foundry floor so as to form a square large enough to admit of taking the pattern inside of the stakes. In driving the stakes they should be kept on a level: this is done with a spirit level and three straight edges, one of them to be a parallel straight edge. Next make a hole in the floor large enough to mould the gear in. If the pattern is 8″ face and you want to make it 12″, place the pattern in the pit with the top of rim 4″ below the top end of the stake, that being done by laying a straight edge across from one stake to the other, and measure from pattern to straight edge. This should be done with accuracy, or the edge of the gear will run out of truth. Next put sand around the pattern and ram it up. When up to top of pattern on the outside and to top of arms on the inside, draw the pattern up one inch. Any more than this is not good, as the draft on the pattern is very apt to make ill-shaped teeth. Then tuck up under the hub and arms, and fill up the teeth and draw the pattern up another inch. Fill up under the hub and arms with facing sand, as this is the last ramming under the arms.

Next, bed in two of the straight edges, one by the side of each two stakes, with the edge up and even with top end of the stakes; then fill up the outside with sand as high as top of the straight edges, and strike it off level. Shape the sand above the rim to correspond with the inside of rim, make a parting and ram up the cope or top part, lift it off, clean the sand away from top of rim, and draw the pattern up one inch at a time, as before, filling the teeth each time. When you have drawn the pattern on a level with the top of the stakes, fill the teeth, make a nice smooth joint, and draw the pattern out and the mould is ready for the finishing touches. The cope should be lifted off after closing the first time, to make sure there is no crush.

Westfield, Mass. JOHN SNOW.

### Information Wanted About Packing.

*Editor American Machinist:*

I would like to ask some of your practical correspondents to help me. I am running a 30″x60″ Corliss engine, making 47½ revolutions, boiler pressure 80 lbs. The engine is a little out of line, but it makes no perceptible difference in the running. My trouble is I cannot keep the stuffing-box packing on piston rod tight. The piston is in line with the guides, but not quite in line with cylinder, or in other words, the cylinder is not quite in line with the frame. The stuffing box will take three rings of 1⅝″ tuck packing.

I would like to know from some engineers who have had similar trouble how they got around it.

I am an old hand at the business, but this beats me. How shall I pack this rod?

R. I.

### Balancing Revolving Bodies.

*Editor American Machinist:*

In your issue of February 21, and also of January 3, Frank H. Ball makes a severe criticism upon a little pamphlet issued by the Defiance Machine Company, detailing their method of balancing pulleys and other rotating bodies, etc. Now, I have by me one of their pamphlets of 1879, and as I see nothing in it which does not accord with my own experience; it seems to me that Mr. Ball makes a pretty bold assertion when he puts it in this way: "I will stake my little reputation right here on the assertion that it contains more errors between its covers than any other mechanical work now in print."

Mr. Ball attacks a statement in the pamphlet: "The reciprocating parts of an engine cannot in any degree be balanced by a counterweight in a rotating part." He gives his experiments, in which he shook the whole western end of his State, etc., and stopped the shaking by putting on counterweight equal to the reciprocating parts. Now, there is nothing in this which is contrary to the statement of the Defiance people, as he would have found if, instead of setting his engine upon a solid foundation, he had mounted it on springs, so that there would have been a vertical vibration equal to the former horizontal vibration. Again, if Mr. Ball's counterbalanced engine had been upended, making it a vertical engine, he would have found his horizontal vibration returned with all its former vigor. In point of fact, the addition of the counterbalance only changes the *direction* of the vibration, in the case of the horizontal engine, from the horizontal direction, where it cannot be well resisted, to the vertical direction, where it is concealed in the weight of foundations, or, as Mr. Porter puts it, "the whole mass of the earth." In a vertical engine, therefore, standing on a foundation, the only parts requiring counterbalance are the rotating parts of the crank and connecting-rod. In a vertical high-speed marine engine, I have obtained the happiest results by making the reciprocating parts as light as possible, and balancing the crank and connecting-rod. A marine engine being in the condition of an engine mounted on springs, the vibration may be divided between horizontal and vertical.

The Defiance people publish certain "maxims," one of which—"Maxim B"—seems to contain the substance of the whole thing, and to which Mr. Ball directs his principal sarcasms. It is as follows, speaking of a rotating body: "Its mechanical center must coincide with its center of gravity, or it will leave its mechanical center, upon which it is supposed to have been set in rotation, and assume a center nearer to the super-abundant weight, by which its equilibrium is destroyed."

Now, Mr. Ball, by an unfortunate use of language, says: "Under no circumstances does the center of gravity of a rotating body seek to coincide with a fixed axis of rotation not co-incident with it." Now, in point of fact, the center of gravity of a body, or a system of bodies, never seeks to change its location in reference to those bodies, whether it be at rest or in motion. But from the tenor of his articles, I infer that he means, in short, that "Maxim B" is not true.

That it is true I propose to show by some little experiments, which I advise all interested persons to try, as they will cost nothing in either time or money.

Take an ordinary knitting needle, which is a steel wire about 9″ long and $\frac{1}{16}$″ diameter, and two ½-ounce rifle bullets. Attach a bullet to each end of the wire, by splitting or boring; if the ends of the wire be roughened by a file, the bullets will stay in place better when hammered together. The center of gravity of this system will obviously be at the center of the wire. We will locate this exactly by suspending the wire from a piece of stout thread, slipping the thread until the wire rests horizontally.

Now try experiment 1: The suspending thread being about 18″ long, twirl it in one direction between the thumbs and fingers of both hands. A good speed of rotation will be soon attained, and nothing very startling developed. The thread will hang perfectly plumb; the two weights and their connecting wire will describe a circle in a horizontal plane. The conditions will be those of a disk or pulley revolving in space, perfectly balanced and left to its own resources. Let the suspending thread remain attached to the center of the wire. Remove the lead of one ball until the center of gravity between the two shall be shifted one inch toward the heavy one. Locate it exactly by balancing, and mark it by tying on a bit of yarn, and proceed with experiment 2: The suspending thread being attached at the center of the wire, the heavy ball when at rest, will hang nearly plumb. On twisting the thread, a rotary pendulum motion will be set up, increasing in amplitude. When sufficient tension of the twisted thread has been attained, a very much higher velocity of rotation than can be sustained by the simple pendulum will ensue, and the wire will revolve in a horizontal plane, and the bit of yarn marking the center of gravity will apparently become a pivot supporting the wire, and the suspending cord which transmits the motion will be describing the slant surface of a cone about it.

The heavy ball will revolve in a circle of 3½″ radius, and the light one in 5½″ radius. The heavy ball has been drawn in and the light one thrown out, and the conditions and results of "Maxim B" will have been attained.

Now for experiment 3: Slip the suspending thread to the position indicated for the center of gravity. Twirl the string as before. The balls will rotate as in experiment 2, the small ball in the large circle and the large ball in the small circle; but the cord will, instead of rotating in a conical form, hang perfectly plumb, as in experiment 1.

I consider the above experiments conclusive proof of the correctness of the statements made in the Defiance pamphlet. As to Mr. Ball's lathe experiment, which caused him to arrive at totally opposite conclusions, I have never seen it tried, but should say that the results he attained must have been brought about by the concussion against the centers, and not by free rotation.

Mr. Editor, did you ever see a boy balancing a top to make it stand up good? I never did. WILLIAM H. HARRISON.

Braintree, Mass.

### Information About Slag Hole in Cupola.

*Editor American Machinist:*

In reply to the correspondent, whose letter you refer to me, who desires information about putting a slag hole in a 36″ cupola, using coke for fuel, I would say, cut about a 3″ round hole in the cupola's shell, and then when lining up cupola form a tapping hole through the lining, similar in form to that you use for letting out the melted iron. The place for a slag hole depends somewhat upon the height and form of tuyeres; also upon the amount of iron you desire to collect in the cupola before tapping out. Place the slag hole as high above the cupola's bottom as will be convenient to hold the amount of iron which can ordinarily be allowed to accumulate before tapping out. You can allow this to bring the top of the slag hole up within about one inch of the bottom of the tuyeres; if any nearer than this the cold blast entering the cupola has a tendency to chill the slag, and if your tuyere is a continuous one, blow it back. Should the tuyeres be such as have a space between them, then place the slag hole about in the middle of the two tuyeres which are the fartherest away from the tapping hole.

When melting, and the slag commences to gather, so as to require letting out, allow the cupola to fill up with melted iron to near the bottom of slag hole, then tap out the slag hole the same as you would the cupola's tapping hole, and let the slag run out, until the melted iron begins to show itself, then the cupola should be tapped out.

In taking the iron out of the cupola, do not, if you can help it, let the blast blow out of the tapping hole. By always leaving some iron in the cupola, you will prevent slag running out of the tapping hole, and thereby prevent its becoming "bunged up" or dirty.

The number of times it will be necessary for you to let the iron rise up, so as to bring up the slag so that it can run out, will, of course, depend upon how fast it gathers. If your iron and fuel are clean, and the cupola is daubed properly, so that its lining stays where it belongs, you should not require to "slag out" but two or three times in a heat of five tons.

To help make the slag fluid and separate it from among the fuel and iron, so that it can be got rid of easily, you should use some flux in charging your cupola, which can be limestone, oyster shells or fluor spar, etc. If you use limestone, it should be broken up to egg size, and of it, or of oyster shells, a small riddle full would be plenty for two tons of iron. With fluor spar, use about 1 lb. per 100 lbs. of iron. For the first two tons of iron charged no flux is necessary, unless the fuel or iron charged is burnt, or dirty.

In making the slag hole, you may, if you choose, attach a spout to the cupola shell; this would lead the slag away from the cupola. If you have plenty of blast, and the blowing of it cannot hurt anything, the slag hole may be left open after its first tap. But as a general thing slag holes are stopped up when not required to be open for the purpose of letting out the slag.

THOMAS D. WEST.

### Should an American Minister Abroad Denounce the Policy of His Government?

We have received the following letter from H. B. Brown, a machinery manufacturer of Easthampton, Conn.:

In your issue of Feb. 7, appears an editorial demand that Mr. James Russell Lowell, our Minister to England, "should be recalled," because he has said that "free trade would enable America soon to equal England's mercantile marine, which had heretofore been impossible through the operation of the American navigation laws and tariff."

You would have Mr. Lowell recalled, "and some American appointed to take his place who will upon every public occasion uphold and defend the distinctive institutions of his country."

Let us suppose Mr. Lowell "recalled," and "some American appointed," as you desire. Let us suppose some "public occasion" presenting the opportunity to "uphold and defend" the aforesaid "navigation laws and tariff" of his native country—what shall he say to the following facts?

In the year 1884, 42,961,799 bushels of grain were exported from New York in 1,120 steamships, of which not one was American. There were also 2,431,988 bushels conveyed by 101 sailing vessels, of which only two were American, and conveyed only 69,354 bushels!

Will the AMERICAN MACHINIST kindly sketch a supposititious speech in which "the representative of this Government" should defend its "foreign and domestic policy," and "the operation of the American navigation laws and tariff," and put to shame "Free Trade—the British policy"—and vindicate "Protection—the American policy?"

Possibly, you would make our American representative argue that it would have been still better for "Protection—the American policy"—and our "navigation laws," if the two American vessels had carried nothing, and lain ingloriously at their docks, while the vile free-trade vessels should have done their work? Would you, really?

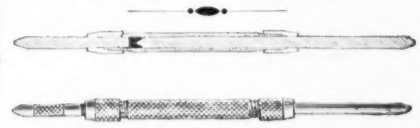
Now, seriously, isn't it about time this nonsense of "protection" should cease? We have but recently fought a bloody war, which resulted in vindicating the right of every man to his own labor, and the products of it. How long will it take us to learn that, by the same logic, every man has the right to invest the products of his labor where it will best serve his own purposes, without the interposition of Governmental power to force him to trade where he does not desire, and at an enhanced cost to himself, that some other party may be "protected?"

I trust the AMERICAN MACHINIST will meet these questions as squarely, in its own columns, in America, as it would have the "American Minister to England" uphold them "on every public occasion."

Mr. Brown seems to think the official duties of the American Minister to England include that of arguing on public and private occasions upon the economic policy of our Government in regard to home affairs. His duties, properly defined, do not involve any such work, unless to *defend* some American policy or institution when assailed at a meeting in which he participates. The Minister to England is paid a salary of $17,000 a year. And for what? Certainly not to publicly deride our national laws or Governmental policy. If the British Minister at Washington were to address a public assemblage on the folly of free trade and the advantages his country would gain by adopting the policy of protection, there would be no hesitation in recalling him, for he would not then represent the policy of his Government. Should the foreign representatives of the United States, who hold the highest rank, have less dignity and pride in upholding the distinctive national policies of their country than the diplomatic representatives of a monarchy? If Mr. Brown thinks they should, we most decidedly disagree with him.

Our navigation laws, as well as some other laws, undoubtedly need revision, but the American Minister to England lowers the dignity of his office by condemning those laws in public.

The tariff views of the AMERICAN MACHINIST are too well known to make it necessary to reply specially to Mr. Brown's questions.



### Adjustable Caliper Gauge.

This little tool is made by the Hartford Tool Company, Hartford, Conn., and will be found a convenient and economical substitute for the wire, usually made after repeated filing and "drawing" to get the exact size.

In the tool shown two "chucks" are arranged, one on each end of a hollow tube. The hole in one end of tube is smooth, so that by loosening the chuck the wire may be quickly slid out or in. In the other end a fine thread is tapped, and a knurled wire is threaded to fit.

In use in taking a size the smooth wire is moved out to give nearly the diameter required, and fastened; then the fine adjustment is made by the threaded wire. Ends of wire are hardened. Any large diameter may be taken by changing the plain wire for a longer one.

People in this country who are required to pay from $2 to $5 per thousand feet of very inferior gas, have reason to envy the gas users in Europe who get all they want for about half a dollar per thousand feet. Even this price, which to us would seem trifling, is not paid without complaint, but gas users over there have recently been gratified by an announcement that an invention has been perfected that will cheapen gas so that it can be sold for two cents per thousand feet. Our gas users would not mind getting some of the benefits of that invention.

The Union Pacific Railway Company has given the Westinghouse Air Brake Company directions of complete the order for brakes for their entire freight equipment at the rate of fifteen sets per day. The number of sets yet to be shipped is ninety-five hundred. When this road is fitted, all the trans-continental lines will be using this brake on their freight cars.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

**American Machinist Publishing Co.**

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

**96 Fulton Street, New York.**

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, ANGUS SINCLAIR, Mechanical Engineers.

**The American News Company,**

Publishers' Agents, New York.

**The International News Company,**

11 BOUVERIE STREET (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

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The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

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$3.50 to Foreign Countries, postage prepaid.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, MARCH 21, 1885.

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## Inquiries Respecting Apprenticeship.

The National Bureau of Education at Washington have determined to investigate the existing condition of the apprenticeship system in our manufacturing industries, and the chief commissioner has issued a circular of inquiry which is published on another page, asking parties engaged in manufacturing pursuits a number of important questions respecting apprentices. A circular letter accompanying the inquiries, says:

"One of the vital questions affecting the present maintenance and future development of American manufacturing industries is the question how employers are to secure an adequate supply of well-trained mechanics. The apprenticeship system of the past, more or less modified to meet modern requirements, has hitherto been almost exclusively relied upon. While in practice that system is gradually becoming obsolete, there is a growing belief among specialists who have studied the subject, that the system itself has survived its effective usefulness and that the manual-labor school is destined to supplant it. In order to reach a settled conviction on this important subject, however, it will be necessary to bring together a considerable amount of trustworthy information; and the accompanying inquiries, to which your attention is respectfully invited, have been prepared with a view to collecting the needed data. When a sufficient number of replies shall have been received to warrant inferences from the facts, the result will be published in a special report on Apprenticeship and Manual Labor Instruction in Schools. Issued by this office in two parts, the first of these will contain a compilation of the apprenticeship laws and decisions thereunder, a brief discussion of apprenticeship at the common law, and a succinct history of the rise, growth, and decay of the system. The last portion of the first volume will contain a résumé and analysis of the replies that may be received to the accompanying questions. The second part of the work will give an account of the attempts in this and other countries to provide trade schools fitted to take the place hitherto filled by the apprenticeship system, and will discuss the various degrees of success which have attended such efforts."

This is a most important investigation and we trust that all employers of labor who are directly or indirectly interested in having skillful help will answer the inquiries to the best of their ability. Whatever views they may hold respecting the training of workmen it is important that others should know them, for this is certainly a case where in a multitude of counsellors there is wisdom. The old hard and fast indentured apprenticeship is no doubt obsolete, yet young men appear to be learning nearly all trades in numbers sufficient to maintain the ranks of skilled workmen. So far as we can learn the trades that young men do not freely find their way into by some means, are those that offer no inducements in the way of pay to skilled workmen. A very beneficent part of the law of demand and supply is curtailing the supply of workmen in such cases and it is not the duty of any bureau to provide an artificial supply in such cases.

Although we believe the indenture apprenticeship system to be obsolete we cannot agree with the Commissioner of Education and the specialists he refers to, who believe that the manual-labor school is going to supplant the apprentice system. Manual schools have an important sphere of usefulness to fill if properly conducted, but they can merely give elementary instruction in the use of leading tools. The repeating of operations which develop skill, and the experience of numerous small manipulations that make up the trade repertory of the skilled workmen can only be learned by doing. The shop or factory is the only place where instruction of this kind can be successfully carried on. The youths who obtain this skill and knowledge may not be called apprentices, but they are acquiring the details of the trade just the same as apprentices were in the habit of doing. Specialists and educational bureaus may think that trades can be learned in manual schools by means of limited operations performed under prolix explanations of the reason for and philosophy of each action; but the employers of skilled labor who will be willing to take as workmen youths who have gone through such a course are few and far between. The employers of labor are called upon in this investigation to state their individual views on the question, and if they respond freely a mass of information will be collected that will prove of great value to the industrial world. Those who have not received circulars and desire to make reports may obtain the list of inquiries on application to Wm. H. Gardiner, acting commissioner Bureau, of Education, Washington, D. C.

Since the Bureau of Education are interesting themselves in the subject of apprenticeships, it would be a good plan for them to use their influence in establishing and promoting night schools where the young men engaged during the day in industrial pursuits might obtain instruction in the principles underlying the business they are engaged in learning. We believe this is the true sphere for the Bureau of Education to work on, if they wish to promote the interests of mechanics and manufacturers at one and the same time. The British Council of Education have for years labored to encourage night schools for the education of mechanics, and their efforts have met with the most gratifying success. If our National Bureau of Education will imitate the example set by their British compeers, they will earn the praise and gratitude of the American people.

## Machinery vs. Moslem.

The prelude to the last act of the bloody drama which Britain and the Mahdi are now playing in the African Soudan is nearly ready for the boards, and it is reserved for American mechanics to play it.

As a necessary step to the subjugation of the fierce Arab tribes who are ranged under the banner of the Moslem pretender, the British Government has determined to lay a pipe line, for the purpose of conveying water for its troops, across the 280 miles of desert between Suakim and Berber, after the manner of the oil pipe lines in successful use in this country.

Manifestly delays and experiments could not be risked in an enterprise upon the speedy success of which so many lives and such important political consequences depend. For the mechanical appliances needed to carry out the proposed plan, the British Government was therefore forced to apply to the American mechanics who were familiar with the problem. The contract for a number of pumping engines adapted to the work has been awarded to an American firm, Henry R. Worthington, of New York, and the Brooklyn works of this firm are working night and day towards its fulfillment. Four engines have been already shipped, and the firm have also offered to furnish the four-inch wrought iron pipe required, at the rate of fifteen miles per day, while confident of their ability to furnish twenty miles per day. It is believed the necessities of the case will require the pipe contract also to be awarded in this country, notwithstanding the efforts of British competitors to secure it.

The pumping engines used are of the Worthington duplex type, non-condensing, and calculated to work under a pressure of 1,000 to 1,500 lbs. per square inch, and have a delivery capacity of 150 to 200 gallons of water per minute—a much less capacity than that of the American oil-pipe lines being required.

Whatever difficulties the British soldiers may encounter in maintaining their foothold in the Soudan, pending the construction and completion of the pipe line, and the narrow-gauge railroad, which is made possible by it, and is presumably likely to follow it, there can be no doubt of John Bull's ultimate ability to whip the Mahdi, now that he has called in the aid of American machinery and American mechanics.

Of the possible ulterior consequences, political and commercial, which may in time follow this move, it is needless now to say much. If the pipe line and railroad accomplish the desired military result, and are preserved, as is probable, for the purposes of peace, important commercial consequences may ensue, the accounts of travelers seeming to agree that in the Soudan region, the desert once passed, lies an immense country, fertile, well watered, and especially adapted for the cultivation of cotton.

## Two Worthy Measures Passed by Congress.

Two measures of great interest and value to the people of this country were passed by the Congress that dissolved last week. One was the restoration to the public domain of 15 million acres of land granted to a railroad company that has never complied with any of the requirements set forth in the grant, and therefore had no just claim to the land. The restoration was fought stubbornly by the company that claimed the right to hold the land, but the vote on the bill was not far from unanimous in its passage through both houses. There was no public sentiment in favor of possession by the railroad company, yet a few newspapers that seem to be bound to defend any kind of a claim set up by a railroad against the people at large wasted considerable good ink and paper in an effort to create such a sentiment.

They seemed to regard those efforts as put forth to benefit general railroad interests.

On the contrary, every paper that defended the land grab was doing an injury to honest railroad interests, by trying to make it appear that they were united in the desire, at least, to keep the lands in possession of the company claiming them.

Much of the public denunciation of railroads in general grows out of the unblushing defence by subservient newspapers, of some unjust claim by a single company, like the Texas Pacific land grab. By habitually reading those papers many people are led to believe that every instance of attempted extortion by a railroad company is defended by all the other companies.

The other beneficial measure passed by the 48th Congress, was the "Act to prohibit the importation and migration of foreigners and aliens under contract to perform labor in the United States, its Territories and the District of Columbia."

It forbids the importation of workmen, by prepaying their transportation and making contracts to perform labor before they start for our shores, under penalty of $1,000 for every offence.

It also subjects the master of a vessel who shall knowingly take as passengers, workmen under such contracts, to a penalty of $500 for every person so imported. He may also be imprisoned six months for the offence.

The act exempts artists, lecturers, singers and several other classes who do not come to this country to depress wages and degrade labor. Skilled workmen may also be engaged in foreign countries to start any new industry in this country where they cannot be obtained at home. The concluding part of the act says:

"Nothing in this act shall be construed as prohibiting any individual from assisting any member of his family or any relative or personal friend to migrate from any foreign country to the United States, for the purpose of settlement here."

The act is not one to prevent voluntary immigration, but to prevent a practice that has grown to be a public evil, viz.: the importation of hordes of white slaves who are of no more benefit to this country than Chinese coolies, to take the places of independent American workmen who cannot live decently upon the wages these slaves are glad to get. Gangs of such workers have been imported within the past year or two only to become paupers, and require public support as soon as mills and shops shut down in certain localities and they were discharged.

This latter act is one that was demanded by the American system of protection to labor. It was opposed by those who are the enemies of such protection. It will not work an injury, but rather a benefit to the emigrant; and where is there an owner of any industrial enterprise who will stand forth and assert that it will work any injury to his business?

In his inaugural address President Cleveland said: "The laws should be rigidly enforced which prohibit the immigration of a servile class to compete with American labor with no intention of acquiring citizenship, and bringing with them and retaining habits and customs repugnant to our civilization."

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.*

(96) **W. J. P., Beloit, Wis.,** will find rules for proportioning cone pulleys in the AMERICAN MACHINIST of October 15 and 22, Nov. 26, 1881, and Feb. 25, 1882.

(97) **B. M. W., Hanover, Pa.,** asks: How are wiped joints made? *A.*—You will find this question answered in the AMERICAN MACHINIST of June 28, 1884.

(98) **G., Taunton, Mass.,** asks: Is hot water used from brass pipes for culinary purposes hurtful? *A.*—There may be some kinds of water that it would not be advisable to use through brass pipes. Generally speaking, we think there is no danger from it.

(99) **H. V., Newark, N. J.,** asks: What power is absorbed by a belt running on a loose pulley? Would I save much power by running the belt off entirely instead of on the loose pulley? *A.*—There is but little power absorbed by a loose pulley, properly arranged. You can save a little power, but not much, by running the belt off.

(100) **D. H., ——,** asks: 1. How is the tempered blue color given to the steel plate and malleable iron of roller skates? *A.*—We do not know how it is given. It could be done, and we presume is, by heating them in a sand bath, or in finely broken charcoal. 2. Where can the right and left toe-clamps be bought? *A.*—We do not know that these are made only by parties who manufacture skates.

(101) **D. H, Bamberg, ——,** asks: Is it practicable to make the cylinder of a 6″x8″ steam engine that has work to do only when the piston is moving in one direction with ports to suit the work, large at one end and small at the other, the valve being worked by an eccentric, and what would be the proper proportion of ports? *A.*—You can accomplish this by making one end of the valve so long that it will not uncover the port at all, then drill small holes through it for admission, until you find by experiment what is right. No idea of proper size of ports can be given without knowing particulars as to speed, what kind of engine it is, and what is the work it is to do.

(102) **P. J. K., Cincinnati, O., writes:** I have an engine 3″x6″, with steam ports ⅜″x2⅜″; exhaust port, ½x2¾″; bridges ⅜″. 1. Are they well proportioned, and what should be dimensions of valve? *A*—The steam ports are ample; a little wider than necessary for any probable speed you will run. The exhaust port would be better if a little wider. It should generally be twice the width of the steam port. You can make the extreme length of valve 2½″; cavity in valve, 1 3-16″; travel of valve, 1 1-16″. 2. What is meant by outside and inside lap? *A.*—If you will lay the valve made according to dimensions given, on the valve face you will find that each edge will overlap the port ¼″. This ¼″ is the outside lap of the valve. You will also find that you must move the valve 1-32″, either way, before the exhaust begins to open. This 1-32″ is the inside lap of the valve.

(103) **E. T., Philadelphia, Pa., asks:** 1. Give practical rule for determining the thickness of metal in steam cylinders? *A.*—Haswell's rule for vertical cylinders is: "Multiply its diameter by the extreme pressure of steam in pounds per square inch that it may be subjected to, and divide the product by 2,400; the result will give the thickness in inches." For horizontal cylinder, "divide by 2,000." 2. Give rule for proper size of steam and exhaust pipes, and for steam and exhaust ports. *A.*—There is no universal rule. The proper proportion of these ports depends upon a variety of circumstances. As a sort of general principle, proportions may be such that steam to the cylinder will not be required to move more than about 100 feet per second, and from the cylinder make the passages somewhat larger. 3. What is a proper feed for a planer on wrought and cast iron, roughing and finishing? *A.*—This will depend upon the quality of the planer, quality of the metal, and of the man who runs the planer. No one can judge of the proper feed to be used under different conditions but an intelligent workman doing the job. 4. Should finishing cuts on large wrought-iron work be as broad as on cast iron? *A.*—Generally, the feed on cast iron, for finishing, may be coarser than on wrought iron. 5. What is the proper distance of grates from boiler for different boilers? Opinions differ widely. The kind of fuel used will also make a difference. Observe for yourself the practice of different builders.

## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*


**Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.**

**Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.**

**"How to Keep Boilers Clean."** A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

**Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.**

Tools for amateur and foot power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

The Young Engineer's Own Book, $3. Edw. Meeks, Publisher, 1002 Walnut St, Phila., Pa.

For Sale—26″ b. g. drill presses, quick ret'n bal. spindles, new, modern tools, $150. S. M. York, Clev'd, O.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N. J.

**Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.**

**Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.**

**The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.**

**Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.**

**Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill**

**R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.**

Cooper, On the Use of Belting, $3.50. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

**Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.**

**Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.**

A few chucks, of all kinds, for sale at half price. Slightly damaged. Send for list to the maker, A. F. Cushman, Hartford, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co, 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

**Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.**

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4.00; books for practical machinists. Address Joshua Rose, Box 3,306, New York City.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.


## MANUFACTURES.

S. M. York, Cleveland, Ohio., will build a new style of drill press.

Childs & Nickerson are putting in a twenty-stamp gold mill near Cleveland, Ga.

Borger Bros. & Co., Columbus, Ohio, will build an addition to their boiler works.

The Eden Gold Mining Company have just started their gold mill at Villa Rica, Ga.

Funds are being subscribed in Ellaville, Ga., for the purpose of boring an artesian well.

The Fall River & Georgia Mining Company are building a gold mill near Villa Rica, Ga.

The town of Greenfield, Mass., has voted $60,000 for the construction of new water works.

John W. Snow, Birmingham, Ala., will erect a new carriage and wagon factory, 100x50 feet.

Augusta, Ga., proposes to enlarge her water works by putting in new pumping machinery.

Gas works are to be established in Thomasville, Ga. H. W. Hopkins has the matter in charge.

The Chattanooga furnaces recently made contracts with Eastern parties for 2,500 tons of pig iron.

The New Orleans & Mississippi Valley Railroad Company are building repair shops at Vicksburg, Miss.

Cornelius Daly, 208 W. 34th Street, New York, will erect a four-story brick factory, 75x42 feet, to cost $9,000.

Willingham & Company, of Columbus, Ga., intend to put up a 3-story building 72x80 feet, for a planing mill.

John F. Bailey, 234 Market Street, Philadelphia, will erect a five story rope factory 100x310 feet, to cost $100,000.

There is a fair prospect for another foundry and machine shop being built at Waseca, Minn, as soon as spring opens.

A. J. Rouch & Company, Dallas, Texas, have purchased ground on which to erect a $50,000 flour mill and grain elevator.

R. F. Barksdale, of Gibson, Ga., is surveying a new railroad, to be known as the "Augusta, Gibson & Sandersville Railroad."

The new foundry at Battle Creek, Mich., will start up with a force of 60 men, which will be increased to 100 in the summer.

The Mount Sterling Iron Fence Foundry and Machine Company, of Mount Sterling, Ky., will erect a foundry during April or May.

Sherman, Texas, is a large and prosperous town, but it has no water works yet. The city council is debating the utility of having them.

The Columbus & Rome (Ga.) Railroad has received $16,000 subscription to its stock for its proposed extension to Greenville, S. C.

The Cornwall Manufacturing Company is to erect extensive pulp mills on the Huron River, just west of Ann Arbor, Mich., as soon as spring opens.

J. W. Higgins, Cass City, Mich., will enlarge his foundry and machine shop for the manufacture of plows and other agricultural implements.

Hodgson & Company, Athens, Ga., who are to erect a $50,000 foundry and machine shop, expect to have the works completed in the early fall.

The Progress Machine Works, Meridian, Miss., will enlarge their foundry and machine shop. They will make a new engine and a new cotton press.

Wright & Adams, Quincy, Ill., have merged their business into the Wright & Adams Company. Capital, $35,000. They will do a general machine business.

The Chesapeake Manufacturing Company, Baltimore, Md., will erect a large screw factory. The enterprise was projected by W. S. Dorman & Company.

The Roseburg (Or.) Iron Works, N. P. Bunnell, proprietor, will be enlarged this summer to double their present capacity. A small plow factory will also be added.

The Duffy Trowbridge Stove Company, of Quincy, Ill., formerly doing business under the firm name of Duffy, Trowbridge & Co., has been incorporated. Capital stock, $125,000.

Citizens of Greenville, S. C., have subscribed $5,200 to the Carolina, Cumberland Gap and Chicago Railroad. J. M. Greer is chairman of the committee having it in charge.

A new catalogue of injectors, ejectors and oil cups has been issued by James Jenks & Company, Detroit, Mich. Four or five different styles of injectors are shown by illustration.

A cotton seed oil refinery will soon be established at Macon, Ga. Col. Wm. B. Johnson and a Mr. Willingham are at the head of it. The refinery will be located near the crushing mill.

It is said that the Oliver Plow Works will remove from South Bend to LaPorte, Ind., the latter city having raised $10,000 as an inducement for them to move. About 500 hands are employed.

The Newton Co-operative Union, of Newton, Ill., has been incorporated for the purpose of manufacturing furniture, and to do a general contracting business in wood work. Capital Stock, $5,000.

The Winston Agricultural Implement Company, of Winston, N. C., will erect a brick building two-and-a-half stories high, with brick shed for foundry. Estimated outlay, $25,000. Will employ about 35 men.

The Worswick Manufacturing Company, manufacturers of radiators and pipe fittings, Cleveland, Ohio, have taken a large building recently occupied by the Cleveland Rolling Mill Company to increase their capacity.

The Hay & Prentice Company, of Chicago, Ill., formerly doing business under the firm name of Hay & Prentice, has been incorporated for the purpose of manufacturing machinery and all kinds of heating apparatus. Capital stock, $100,000.

A newly organized company, with ex-Postmaster-General James at its head, is negotiating for the purchase of the old watch works at Marion, N. J., to be used as a factory for the manufacture of the Hopkins mower and other agricultural machinery.

The Duplex Printing Press Company, Battle Creek, Mich., has been incorporated for the manufacture of printing presses. Capital stock, $60,000. Irving L. Stone, W. H. Pettibone, A. W. Alvord and Charles A. Dell, all of Battle Creek, Mich., incorporators.

The Lockport Paper Company, of Lockport, N. Y., have nearly completed their new mill, and are now setting up the machinery. The Pusey & Jones Manufacturing Company furnish the cylinder machine, which will be driven by a Westinghouse automatic engine.

Barnaby & Wetherell have been given the contract for building a new rolling mill for the Taunton (Mass.) Copper Manufacturing Company, at Weir Village, and work will begin in April, the hard pine timber having been already ordered. The new mill will be 126x80, with an L 38½x50; will be furnished with two new engines, and built in accordance with the modern style of mill construction.

It is stated that C. P. Huntington has purchased 11 squares of ground in New Orleans, La., adjoining the depot of the Mississippi Valley Railroad, on which to erect additional freight warehouses, sheds, round-house, car and repair shops, etc., for this railroad.—*Baltimore Manufacturers' Record.*

In your issue of March 7, 1885, says a correspondent, you give notice as follows: "James Ostrander, Champaign, Ill., will start a machine shop at Middlebranch, Kansas." It will be fitted with new tools. The firm will be Ostrander & Stayman, and the location Winfield, Kansas. Members—James Ostrander and John M. Stayman.

Westinghouse, Church, Kerr & Company, contracting engineers, of New York, have just closed a contract with Arbuckle Bros., coffee dealers, of New York, for four engines of 125 H. P. each, to be placed and run on the sixth floor of the large coffee roasting establishment of the above firm in Brooklyn.

Phillip Hass, superintendent of Andrews Bros'. Works, Youngstown, Ohio, is perfecting a pin and link machine whose capacity is 12 links per minute. This machine, unlike the ordinary ones, makes both ends of the links and finishes ready for welding. On trial, it kept steadily at work, making 420 lnks per hour.—*Industrial World.*

The R. H. Allen Company, of Brooklyn and New York, has been incorporated to make agricultural implements. Capital stock, $100,000. The incorporators are Charles H. Pinkham, Jr., of Salem, Mass.; Charles W. Compton and Thomas W. Hall, of Brooklyn; Enos B. Parsons, of Rochester, N. Y., and Joaquin A. Medina, of New York.

Boynton & Plummer, Worcester, Mass., have issued a neatly-printed and well arranged catalogue and price-list of machines for small machine shops, blacksmiths, and carriage-makers, as manufactured by that firm. Among their specialties are shaping machines, of 6, 8, and 10-inch stroke (which have become quite popular), bolt cutters, and a full line of blacksmiths' drills, both upright and horizontal. The catalogue is fully illustrated and the machines described.

On the floor of the machine shop of the Dickson Manufacturing Works at Scranton, Pa., there are some very heavy pieces intended to form part of a large air compressor, designed by Mr. E. D. Leavitt Jr., for the Calumet and Hecla Mining Company. There is a bedplate that weighs 50,000 pounds, a steel shaft 19″ diameter, a gear wheel 20 feet diameter and 20 inches face, and other parts in proportion. The main cylinder, which is not yet on the floor, will be 42 inches diameter.

Steel tacks are now being made at all the tack shops in Taunton, it having been found that they could be made much cheaper than the iron ones, and also that they were much better for household uses than the ordinary wire ones. When a steel tack goes into a carpet it can be pulled out without pulling off the head. The wire nails are found useful in all light work, and have taken the place of brads, because of the facility with which they can be driven into any kind of light wood without splitting it, and the tenacity with which they hold. *Boston Commercial Bulletin.*

Israel H. Johnson, Jr., & Co., Philadelphia, Pa., have issued a large illustrated catalogue of metal-working tools and machinery made by that firm. They state in preface that only a portion of the tools and machinery made by them are represented in the catalogue. Lathes of various kinds, milling machines, cutting-off machines, centering machines, drilling and boring machines, screw machines, metal sawing machines, buffing machines, punching and shearing machines, boiler rolls, power pumps, presses, and various attachments are shown. The firm occupies a large structure, built for their business, at 1422, 1424 and 1426 Callowhill Street, half a square from the Reading Railroad depot.

The Westinghouse Machine Company, of Pittsburgh, Pa., still keep up their boom in setting engines for about every situation where power is used. They are selling a good many to Europe, mostly to England and Holland. One recent order was for a 15 H.P. automatic for the British Admiralty, and another for a 9½″x9″ engine, to run the electric lights in the South Kensington Museum. The latter will run 550 revolutions a minute. Givernaud Bros., silk manufacturers of Hoboken and elsewhere, have just ordered another Westinghouse automatic engine, making the ninth within two years; E. Balbach & Sons, assayers, of Newark, have placed two orders, for 25 and 35 H. P. respectively, making the seventh Westinghouse engine in their works within the same time.

The H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, have recently brought out a plastic stove lining, composed of asbestos and some other fireproof materials, which is attracting notice in the stove trade. This stove lining or cement is easily applied with a trowel, and forms, it is said, an exceedingly durable and economical lining for cooking and heating stoves, ranges, and furnaces, and for the lining of fire doors of boilers, furnaces, etc. It is also pronounced of great value and convenience for repairing stove and flue joints, broken fire-brick, iron linings, and other surfaces exposed to heat. This company has also recently issued a new illustrated catalogue of asbestos goods manufactured by them, containing reduced prices on many kinds of goods, including asbestos packing and boiler-covering, abestos cloth, cord, twine, yarn, sheathing, building felt, cement and stove lining.

Large car shops are to be erected this spring at Altoona, three miles from Eau Claire, Minn., for the Omaha Railroad Company.

Ryan, May & Latus have fitted up a new building (three floors) for the manufacture of gas fixtures and church candlesticks, at 9 Bleecker Street, New York. They have had several years' experience in the business, and have brought out some new and tasteful patterns.

### Machinists' Supplies and Iron.

NEW YORK, March 5, 1885.

A ramble among dealers develops the fact that the supply trade is improving, although the increase in business is yet small. Some of the dealers spoke in a depressed tone, and would recognize no improvement in the trade prospects, but others are quite sanguine of better times being at hand, and already acknowledged demand for goods to be on the increase. All through, the tone was better than we have heard it for some time. Several of the dealers complained that prices were more depressed than business, and they blamed manufacturers for protracting the reign of low prices by dealing direct with customers, and giving them the same quotations as dealers receive. Those who deal most with railroad companies find those who refrained from buying so persistently last year are now disposed to supply more than their daily wants call for. When this tendency extends a little more it will exert a beneficial influence on the whole machine and supply trade.

So fas as we can learn, the outlook for locomotive building is a little better than it was at the beginning of last year. Many people, who have studied out the peculiarities of railroad necessities, think the demand for new locomotives will come with a sudden rush, as it did several years ago.

Iron—The promises of the beginning of the year seem not to be realized in the pig iron business, for consumers have fallen into their old practice of buying from hand to mouth, and the demand continues limited. This policy of buying merely to provide for immediate wants, although exercising a depressing influence, has not broken prices, for values continue to rule firm, one of the most promising features of the situation. Standard Lehigh brands are quoted $18 to $18.50 for No. 1 X Foundry; $17 to $17.50 for No. 2 X, both at tidewater; Grey Forge, $14.50 to $15.50, at furnace. Other brands from 50c. to $1 less.

Scotch pig—Foreign brands seem to be more depressed than domestic iron. The transactions in Scotch pig are mostly confined to small lots, and tendency of prices is in favor of buyers. We quote Shotts $21.50 to $21.75, to arrive; Coltness, $21.50 to $21.75, to arrive; Glengarnock, $19 to $19.50, to arrive; Gartsherrie, $20.50; Summerlee, $20.50; Carnbroe, $19, to arrive; Eglinton, $18.50 Langloan, $21; Dalmellington, $19.

Copper—Ingot continues dull, without change Lake has sold at 11¾ to 11¼ cents. Other brands, 10½ to 10¾ cents.

Lead—The demand for pig is light, carload lots being quoted at 3.62 to 3.65 cents.

Tin—This market has been rather fluctuating. We quote for jobbing lots Banca, 18½ cents; Straits and Malacca, 17.65 to 17.75.

## ✻WANTED✻

*"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.*

Wanted—To learn machinist's trade, by industrious young man. F. B., Box 84, Sunbury, Ohio.

Situation wanted by an iron foundry supt. or foreman. Adddress Iron Founder, AM. MACHINIST.

Mech. engineer, of good address and experience, wishes to travel part time for good firm. Address Box 2, AM. MACHINIST.

An experienced engineer desires a position as chief draftsman or superintendent. Address N. S. S., AM. MACHINIST.

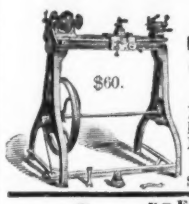
Wanted—Position as manager, superintendent or designer, by Mechanical Engineer who has had a technical education and ten years' practical experience in mech. work and the above positions. Best references. Address Box 15, AM. MACHINIST.

A thoroughly practical man, with ten years' experience, desires position as superintendent or foreman in some light manufacturing business. Is practical toolmaker, and competent to construct special machinery. Good references given. Address M. J. D., AM. MACHINIST.

Wanted—A foreman blacksmith; one who thoroughly understands engine and general machinery work—to take charge of a shop with 12 to 14 fires; must be sober, reliable, and pushing. None other need apply. To the right man steady employment can be given. Apply by letter, giving age, experience & references, to Drawer 130, Brantford, Canada.

For sale or royalty—Trip hammer. Pat. 302,811. John R. Abbe, 9th and Spruce Sts., St. Louis, Mo.


**CHANDLER & FARQUHAR,**
*168 Devonshire Street,*
BOSTON, MASS.
TOOLS AND SUPPLIES
FOR
Machinists, Plumbers, Gas Fitters, Electricians, Model Makers, Roller Skate Makers, Amateurs, Etc.
Send for Catalogue B.




ESTABLISHED 1832.
Over 800 in Use
BRADLEY'S CUSHIONED HAMMER.
Stands to-day without an Equal.
It approaches nearer the action of the Smith's Arm than any Hammer in the WORLD.
BRADLEY & CO., Syracuse, N. Y.

COOKE & COMP'Y,
PORTABLE FORGES.
Durable, light, low-priced.
For Blacksmiths, Gunsmiths, Riveters, Carriage Makers, &c. Write for Circular.
121 CORTLANDT STREET, NEW YORK.

WHITE'S FLEXIBLE METALLIC FILLET
FOR PATTERN MAKERS' USE.
1/2" 3/8" 5/16" 1/4"
Can be applied in one-tenth the time required to carve curved fillets. Send for sample. H. B. Smith Machine Co., Mfrs. of Wood Working Machinery, 925 Market St., Phila.

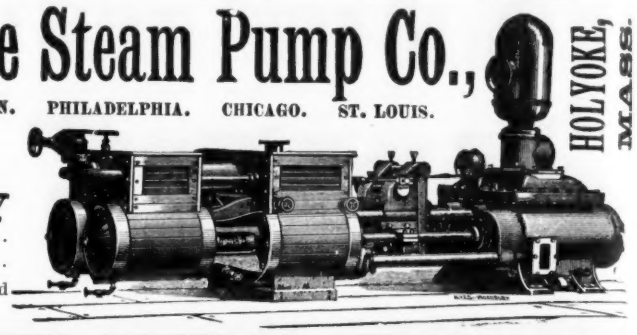
THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION
KNOWLTON MFG. CO., King St., Rockford, Ill.

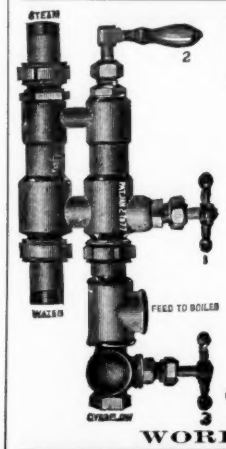
FOR SALE AT A BARGAIN
A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock. The business will be carried on until sold. Address
A. FALKENAU, Leadville, Colo.,
Or 123 E. 72d St., New York City.
Only reason for selling, ILL-HEALTH.

STEPHENS PATENT VISES.
50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r, Office, 41 Dey St., New York.

Massey's E & K Patent VISES.
NO LOST MOTION.
Simply constructed, convenient and durable.
T. C. MASSEY,
Sole Manufacturer,
15 S. Jefferson St.,
CHICAGO, ILL.
Eastern Depot,
LINK BELT CO.
81 John St., N. Y.
Write for Description.

The Deane Steam Pump Co., HOLYOKE, MASS.
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.
MANUFACTURE
PUMPING MACHINERY
FOR ALL DUTIES.
Send for New Illustrated Catalogue.



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THE STANDARD
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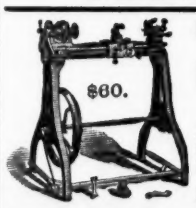


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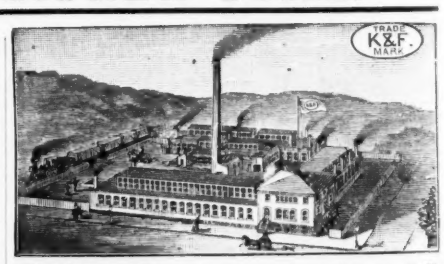


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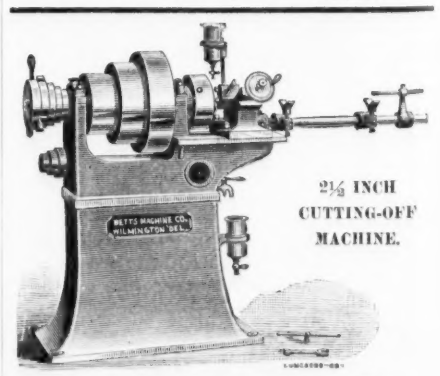


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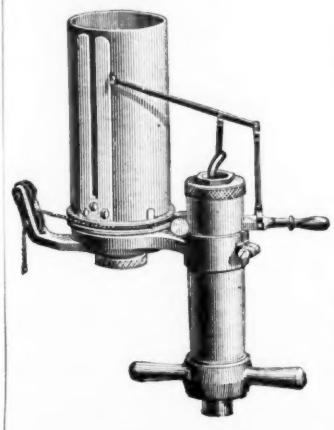

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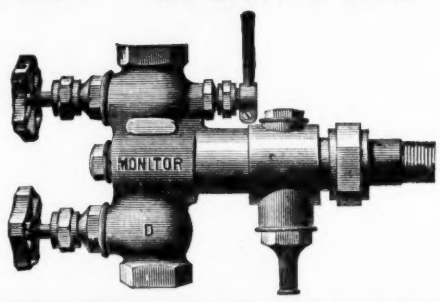


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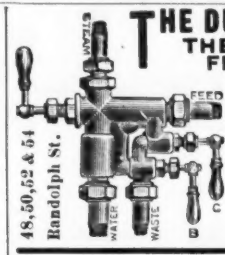


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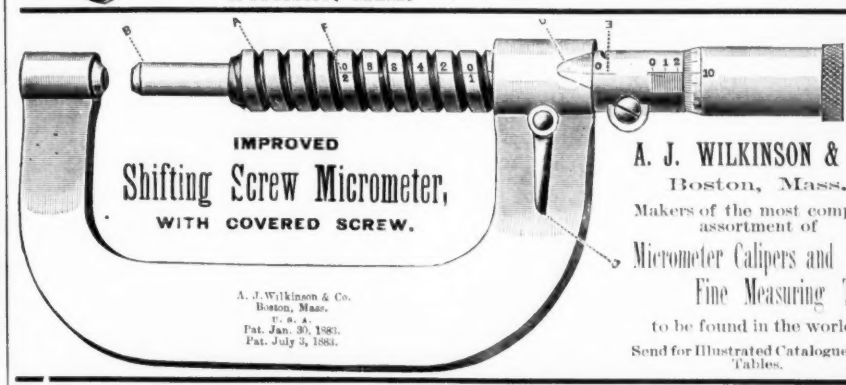


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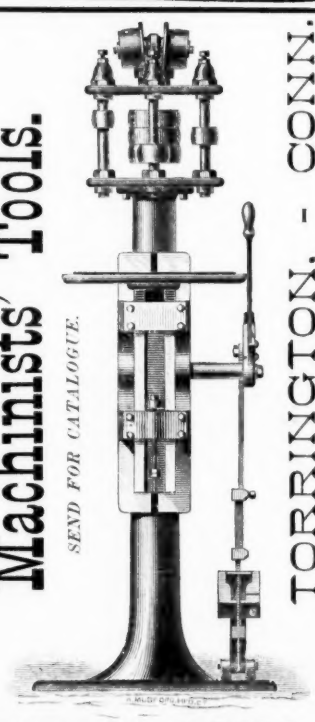

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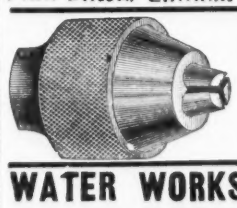

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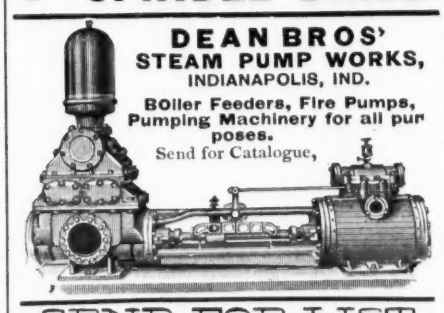

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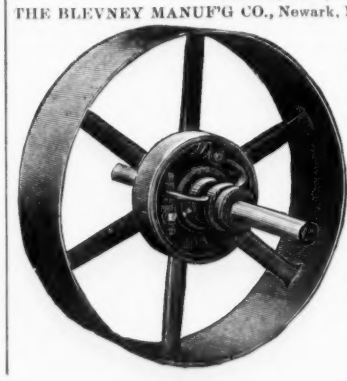

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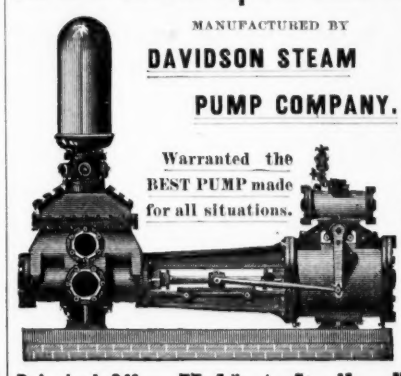

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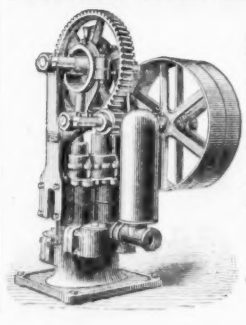

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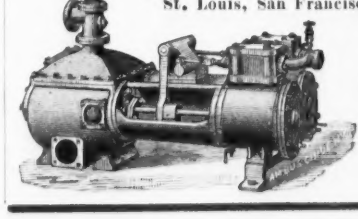

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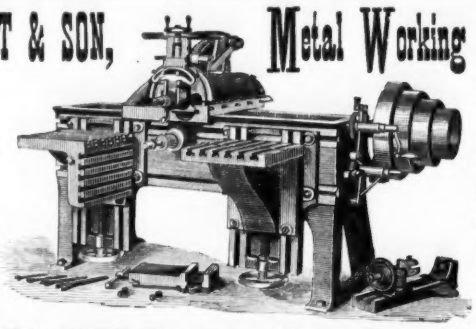

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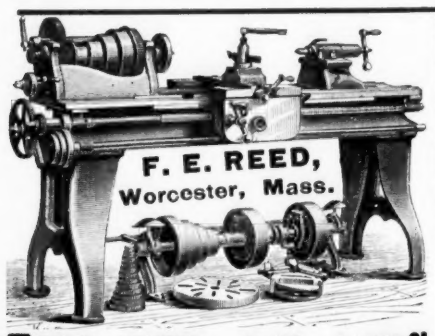


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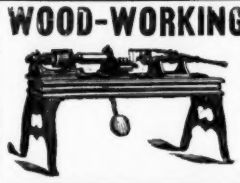

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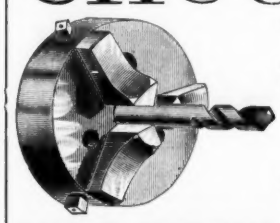

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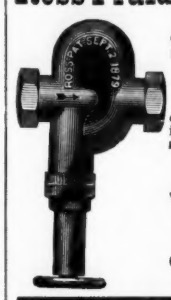

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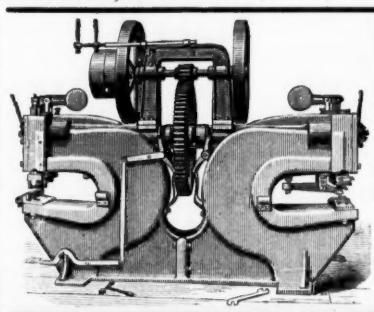

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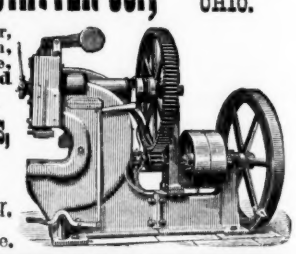

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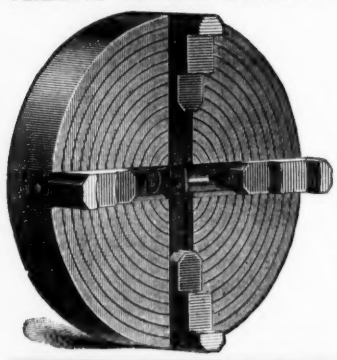

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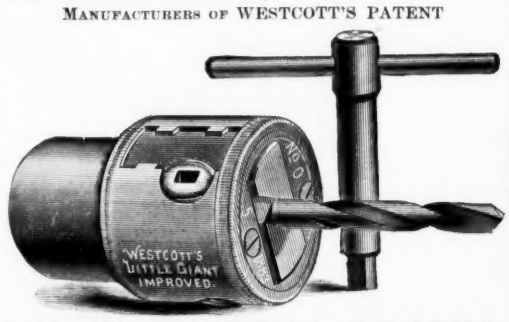


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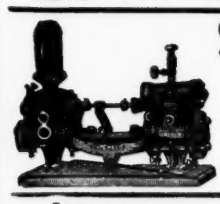

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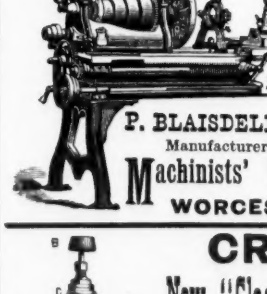

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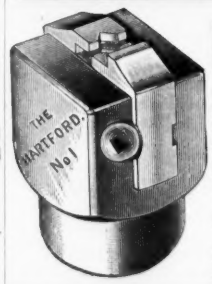


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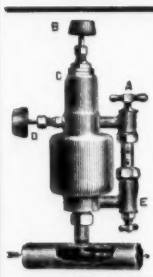


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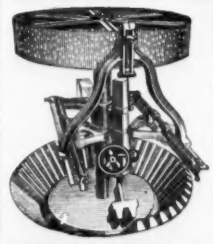

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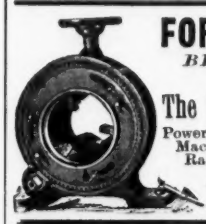

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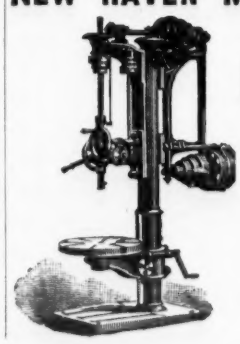

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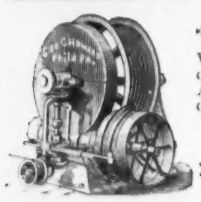

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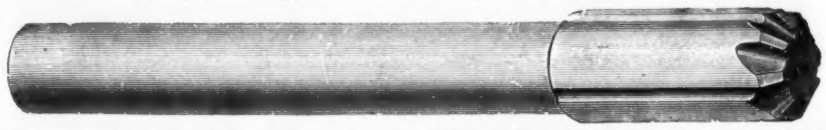

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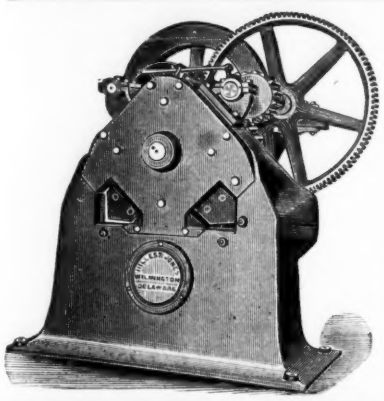

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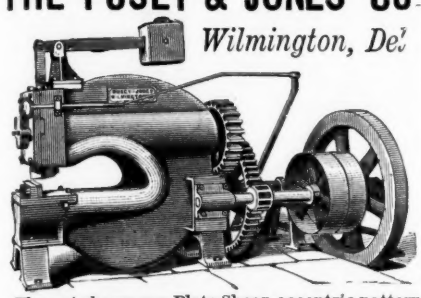

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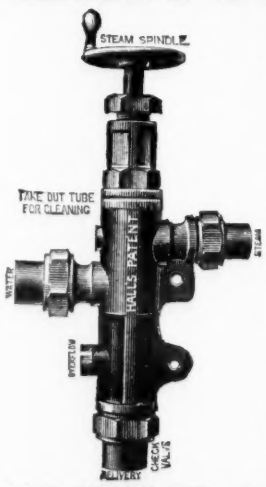


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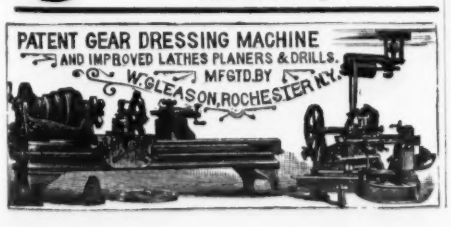

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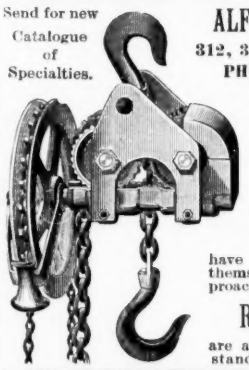

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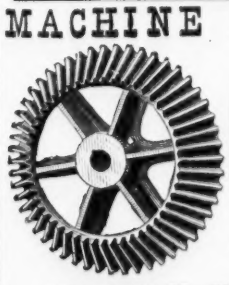

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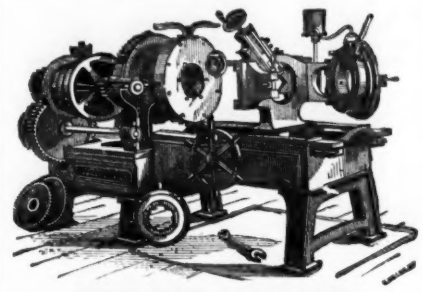

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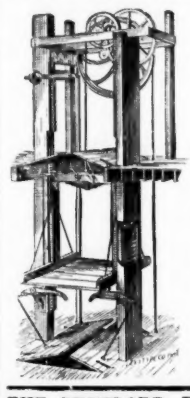

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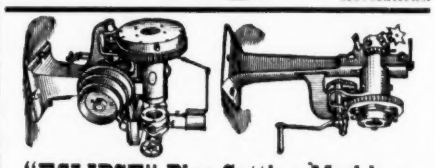

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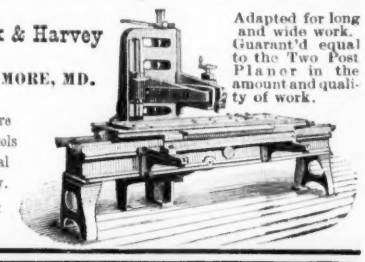

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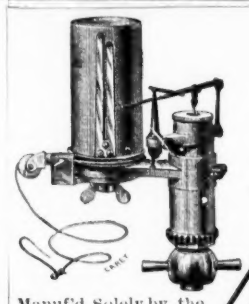

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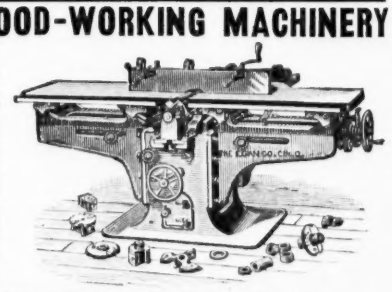

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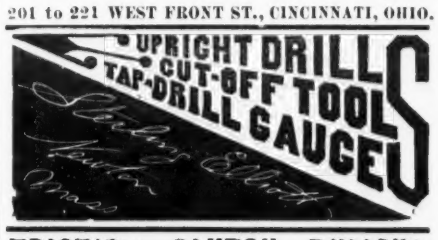


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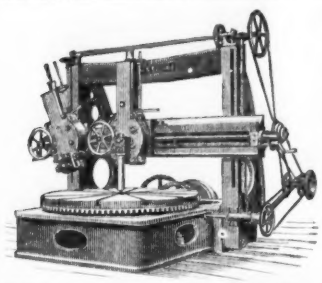

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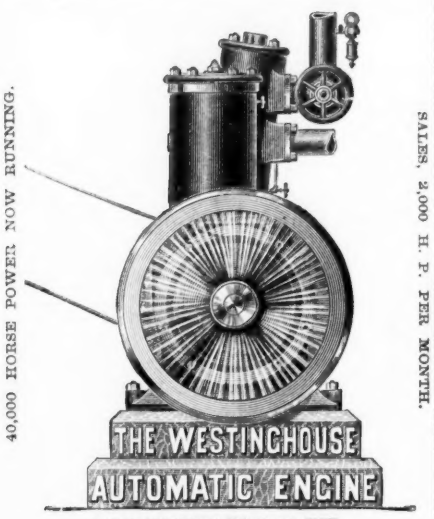


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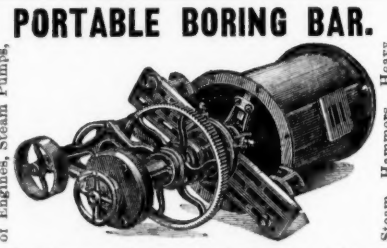

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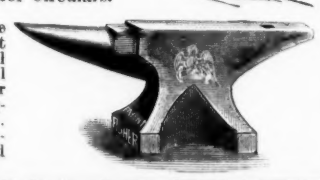

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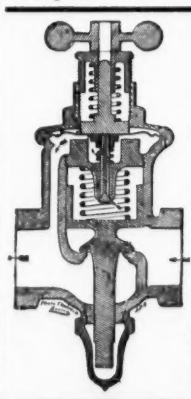

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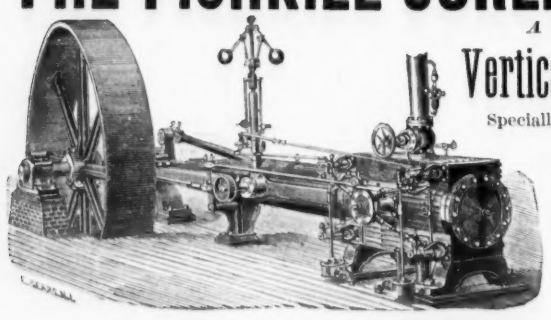

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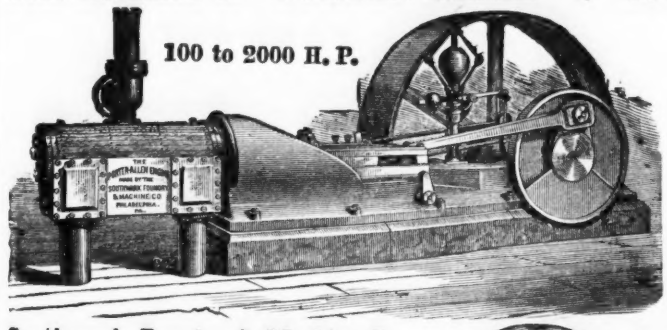

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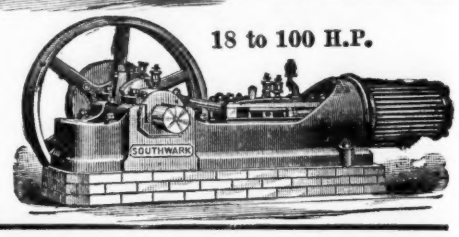


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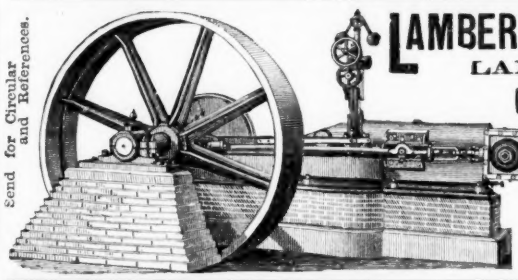

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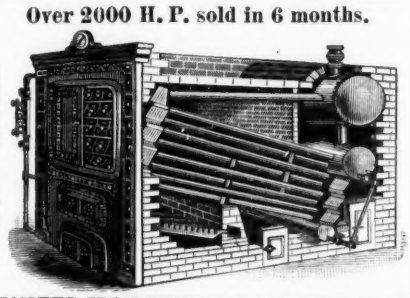

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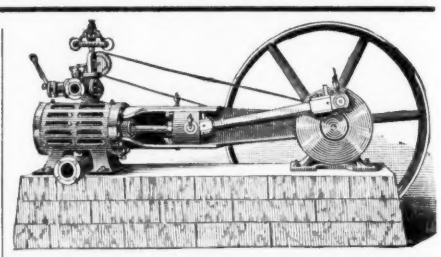

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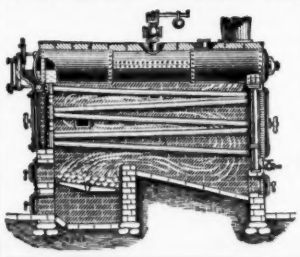

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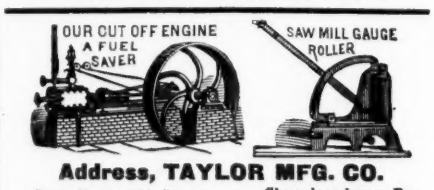


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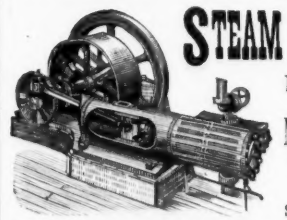

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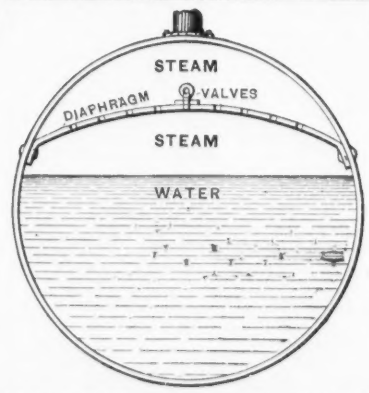


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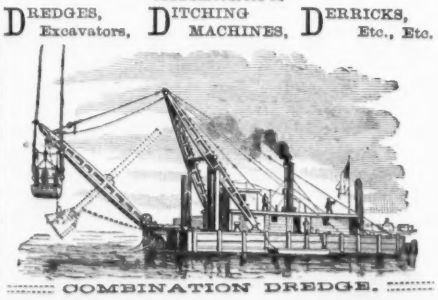

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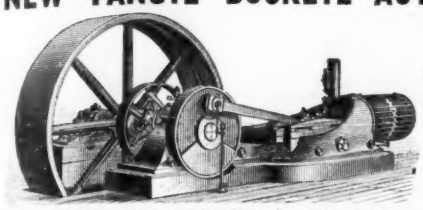

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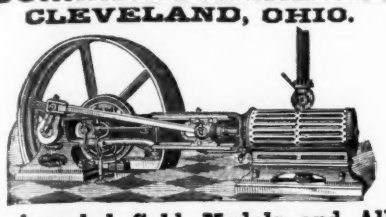

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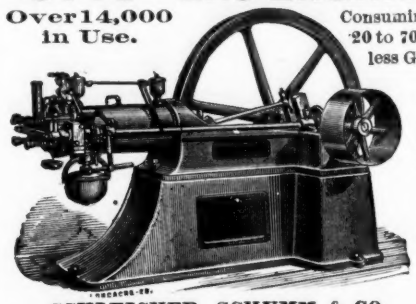

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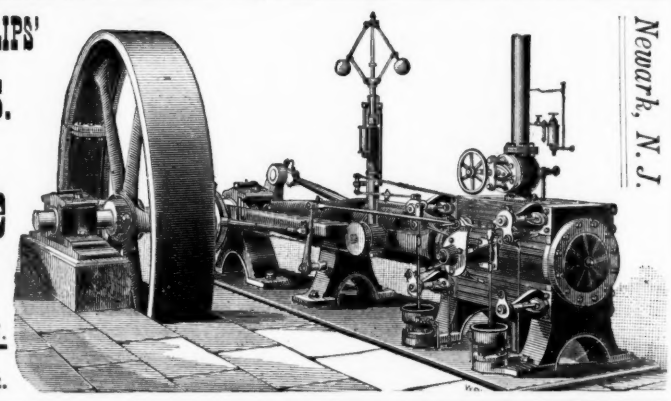

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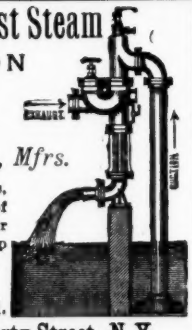


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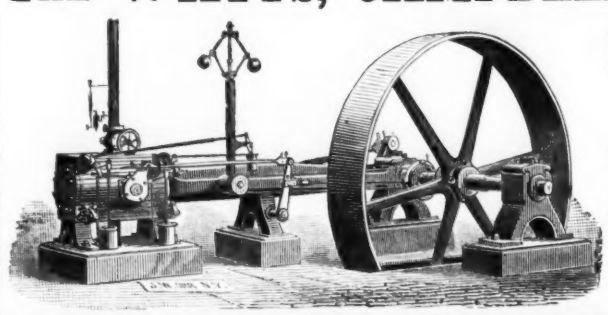

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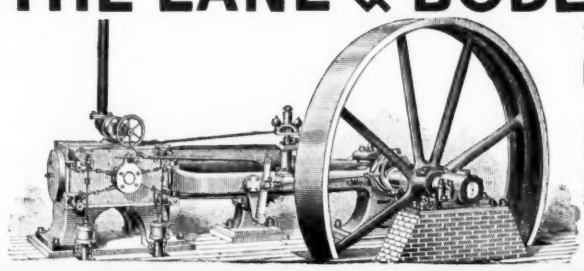

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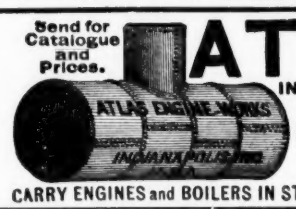


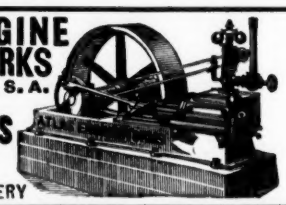

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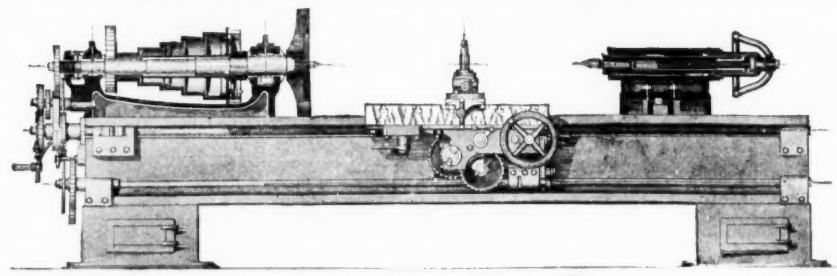

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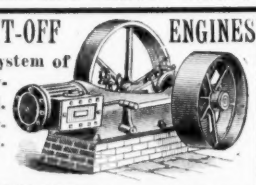

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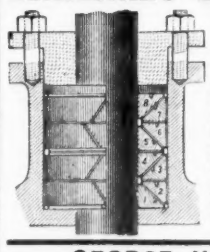

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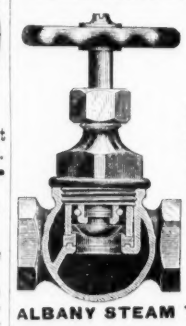

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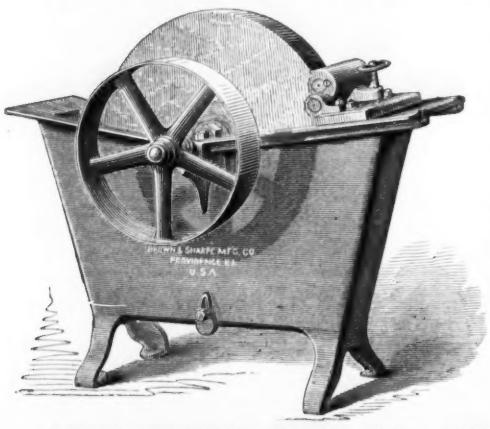

This cut represents a grindstone trough combining a number of very desirable qualities. In addition to the ordinary arrangement of trough, spindle, and pulley, it is provided with self-oiling boxes and an adjustable truing device which can be instantly applied to the face of the stone, working automatically, and without dust, keeping the face of stone always in good shape without interfering with its constant use.

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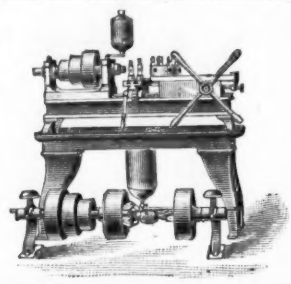

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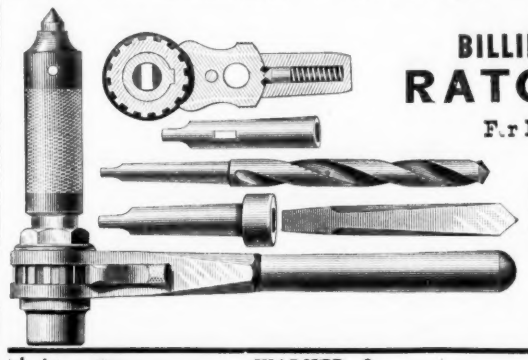

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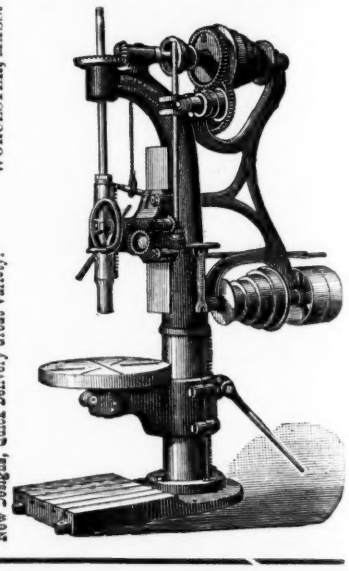

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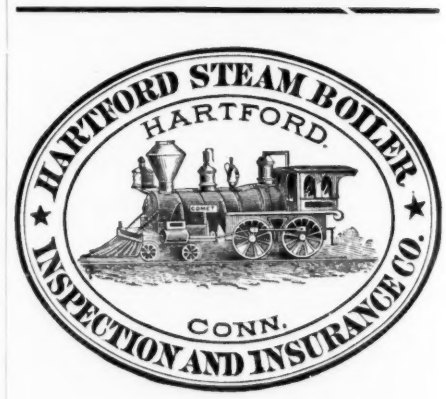


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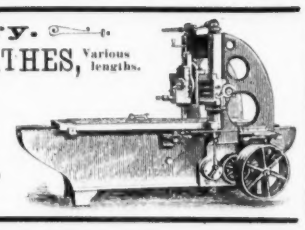

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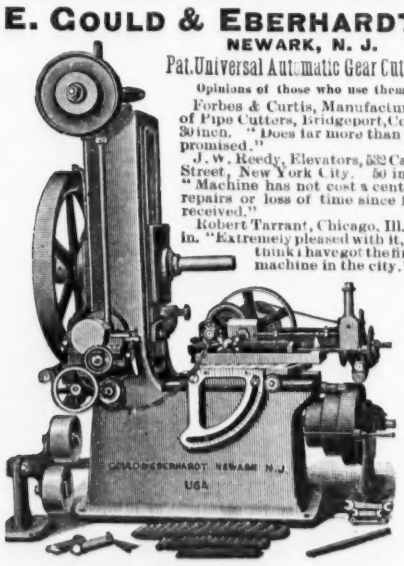


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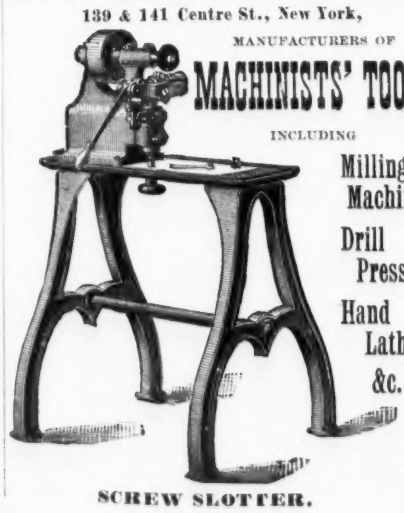

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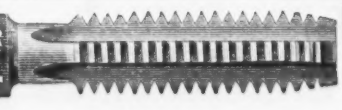

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